Service Authority
Prince William County

Environmental Services and Water Reclamation
Evelyn Mahieu, Ph. D, Director

P.O. Box 2266 Woodbridge, VA 22195 Telephone 703-335-7932
Fax 703-335-8933

April 14, 2015

Ms. Anna Westernik
Environmental Specialist
Department of Environmental Quality
Northern Virginia Regional Office
13901 Crown Court
Woodbridge, VA 22193

Re: "Prince William County Service Authority Occoquan Forest WTP – VPA0007 Permit Application"

Dear Ms. Westernik:

Attached is the VPA permit renewal package for the Occoquan Forest Wastewater Treatment Plant – VPA00007. The majority of the data presented is for calendar year 2014.

The Authority is in the process of designing and building a new pump station and sewer to serve the 220 single family homes in the Occoquan Forest subdivision. When complete, the new system will deliver flows from Occoquan Forest to the H.L. Mooney Advanced Water Reclamation Facility. We expect the construction of the pump station to be completed by May 2016.

In the interim, we request that the Department of Environmental Quality administratively continue the Occoquan Forest VPA permit #VPA00007.

If you have any questions or concerns, please feel free to contact me.

Sincerely,

Evelyn Mahieu

Evelyn Mahieu
Director of Environmental Services and
Water Reclamation

Enclosure

cc: Samer Beidas, PWCSA
Steve Bennett, PWCSA
Maureen O'Shaughnessy, PWCSA
Rachel Carlson, PWCSA

VIRGINIA POLLUTION ABATEMENT (VPA)

PERMIT APPLICATION

FORM A – GENERAL INFORMATION

Department of Environmental Quality

Department of Environmental Quality
VIRGINIA POLLUTION ABATEMENT PERMIT APPLICATION
FORM A – GENERAL INFORMATION

INSTRUCTIONS

All applications submitted for a Virginia Pollution Abatement (VPA) Permit shall include this form.

1. **FACILITY OR APPLICANT INFORMATION**:
   a. If applying for a permit which will authorize management of pollutants at a facility, including but not limited to a wastewater treatment plant, sludge treatment facility, routine storage facility (not located at the treatment plant), or an Animal Feeding Operation (AFO), provide the following information:
      - Facility Name: The legal name of the facility managing the pollutants,
      - City/County: The city or county in which the facility is located,
      - Physical Location/Address: The physical location or address of the facility, and
      - Mailing Address: The mailing address of the facility. If the same as physical address write SAME.

   b. If applying for a permit to authorize land application activities only, where no facility is included, provide the following information:
      - Applicant Name: The name of the applicant,
      - City/County: The city or county in which the land application is proposed,
      - Physical Location/Address: The physical address of the office which will manage the activities, and
      - Mailing Address: The mailing address of the office which will manage the activities. If the same as physical address write SAME.

2. **OWNER INFORMATION**: Provide the legal name, mailing address, telephone number and e-mail address of the owner or the company making application for the VPA Permit.

3. **OWNER CONTACT INFORMATION**: Provide the name, title, mailing address, telephone number and e-mail address of the individual whom DEQ staff should contact regarding this application. If the owner contact is the same as the owner, write SAME.

4. **EXISTING PERMITS**: List all environmentally-related permits issued to the facility by listing the issuing agency and permit number. Include an existing VPA permit if your facility has one.

5. **NATURE OF BUSINESS**: Provide a general statement of the type of business conducted at the facility. Industrial facilities are requested to provide applicable Standard Industrial Classification (SIC) Codes. SIC Codes may be obtained from Standard Industrial Classification Manual published by the U.S. Department of Labor, Occupational Safety and Health Administration. The manual can be found in public libraries and on the internet.

6. **TYPE OF POLLUTANT MANAGEMENT ACTIVITY**: Indicate pollutants or type of waste(s) handled and whether the facilities are either existing or proposed, or both. Note that the pollutant or type of waste determines which other VPA application forms must be completed. Applicants may also contact the DEQ for assistance.

7. **GENERAL LOCATION MAP**: The purpose of the map is to allow the DEQ staff to readily find the establishment. This map is to show the general location of the establishment. Applicants should use county or United States Geological Survey quadrangle maps. DEQ Regional Offices can provide information for obtaining such maps.

8. **CONSENT TO RECEIVE AND CERTIFY RECEIPT OF ELECTRONIC MAIL**: The Department of Environmental Quality (DEQ) may deliver permits, certifications and plan approvals to recipients, including applicants or permittees, by electronically certified mail where the recipients notify DEQ of their consent to receive mail electronically (§ 10.1-1183). Check only one of the options.

9. **SIGNATURE AND CERTIFICATION STATEMENT:** The application must be signed in accordance with the VPA Permit Regulation (9VAC25-32):
   a. **FOR A CORPORATION**: by a responsible corporate official. For purposes of this section, a responsible corporate official means (l) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision making functions for the corporation, or (2) the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding $25,000,000 (in second-quarter l980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.
   b. **FOR A MUNICIPALITY, STATE, FEDERAL OR OTHER PUBLIC AGENCY**, by either a principal executive officer or ranking elected official. (A principal executive officer of a Federal, Municipal, or State agency includes the chief executive officer of the agency or head executive officer having responsibility for the overall operation of a principal geographic unit of the agency).
   c. **FOR A PARTNERSHIP OR SOLE PROPRIETORSHIP**, by a general partner or the proprietor, respectively.

VIRGINIA POLLUTION ABATEMENT PERMIT APPLICATION
FORM A
ALL APPLICANTS

1. FACILITY OR APPLICANT INFORMATION

Facility Name or Applicant Name:	Occoquan Forest Wastewater Treatment Plant
County/City:	Prince William County
Physical Location/ Address:	5901 Davis Ford Road, Manassas, VA 22111
Mailing Address:	P.O. Box 2266, Woodbridge, VA 22195-2266

2. OWNER INFORMATION

Owner Legal Name:	Prince William County Service Authority
Mailing Address:	P.O. Box 2266, Woodbridge, VA 22195-2266
Telephone Number:	703 335 7950
Email address:	bennett@pwcsa.org

3. OWNER CONTACT INFORMATION

Owner Contact Name:	Stephen M. Bennett
Title:	Deputy Director of Water Reclamation
Mailing Address:	P.O. Box 2266, Woodbridge, VA 22195-2266
Telephone Number:	703 393 2062
Email address:	bennett@pwcsa.org

4. EXISTING PERMITS: (e.g., VPA, VPDES; VWP, RCRA; UIC; other)

Agency	Permit Type	Permit Number
VA DEQ	VPA	VPA00007

5. NATURE OF BUSINESS: Domestic Wastewater Treatment

SIC Code(s):	4952	Sewerage System	

VIRGINIA POLLUTION ABATEMENT PERMIT APPLICATION
FORM A
ALL APPLICANTS

6. TYPE OF POLLUTANT MANAGEMENT ACTIVITY: *check the appropriate box(es)*

	Proposed	Existing
Animal Feeding Operations (complete Form B)	☐	☐
Industrial Waste (complete Form C & Form D: Parts D-V & D-VI)	☐	☐
Land Application of Municipal Effluent (complete Form D: Parts D-I & D-III)	☐	X☐
Land Application of Biosolids/Sewage Sludge (complete Form D: Parts D-II, D-IV, D-V & D-VI; and Liability Requirements for Transport, Storage and Land Application of Biosolids Form)	☐	☐
Reclamation and/or Distribution of Reclaimed Wastewater (Application Addendum)	☐	☐

7. GENERAL LOCATION MAP:

Provide a general location map which clearly identifies the location of the facility. **See Attachment 1**

8. CONSENT TO RECEIVE AND CERTIFY RECEIPT OF ELECTRONIC MAIL:

The Department of Environmental Quality (DEQ) may deliver permits, certifications and plan approvals to recipients, including applicants or permittees, by electronically certified mail where the recipients notify DEQ of their consent to receive mail electronically (§ 10.1-1183). Check only one of the following to consent to or decline receipt of electronic mail from DEQ as follows:

X☐ Applicant or permittee agrees to receive by electronic mail the permit and any plan approvals associated with the permit that may be issued for the proposed pollutant management activity, and to certify receipt of such electronic mail when requested by the DEQ.

☐ Applicant or permittee declines to receive by electronic mail the permit and any plan approvals associated with the permit that may be issued for the proposed pollutant management activity.

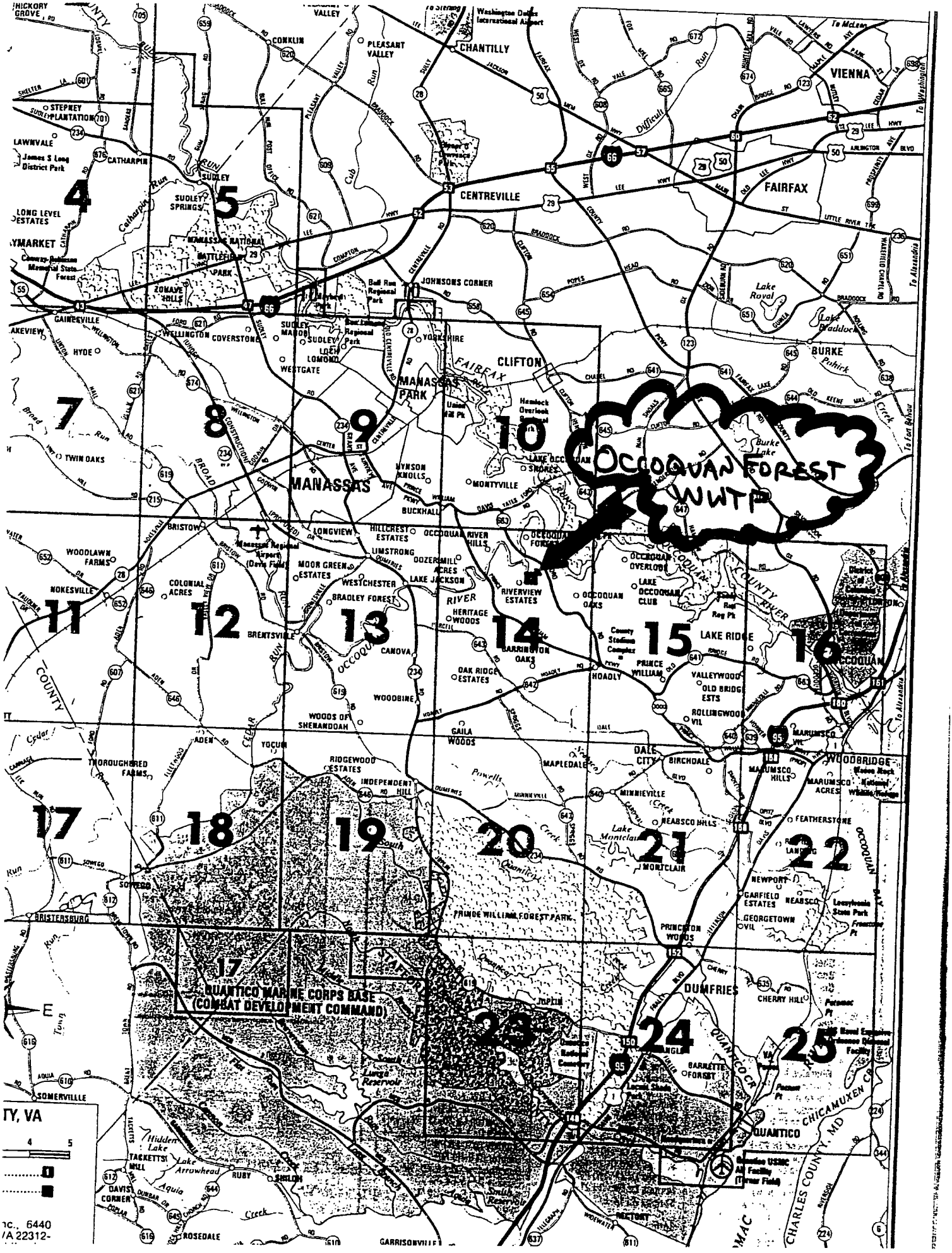
9. SIGNATURE AND CERTIFICATION STATEMENT:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering information, the information submitted is to the best of my knowledge and belief true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment for knowing violations. I further certify that I am an authorized signatory as specified in the VPA Permit Regulation (9VAC25-32).

Signature:	Evelyn Mahieu	Date:	4/14/15
Printed Name:	Dr. Evelyn Mahieu		
Title:	Director of Environmental Services and Water Reclamation		

ATTACHMENT 1

GENERAL LOCATION MAP


OCCOQUAN FOREST WWTP
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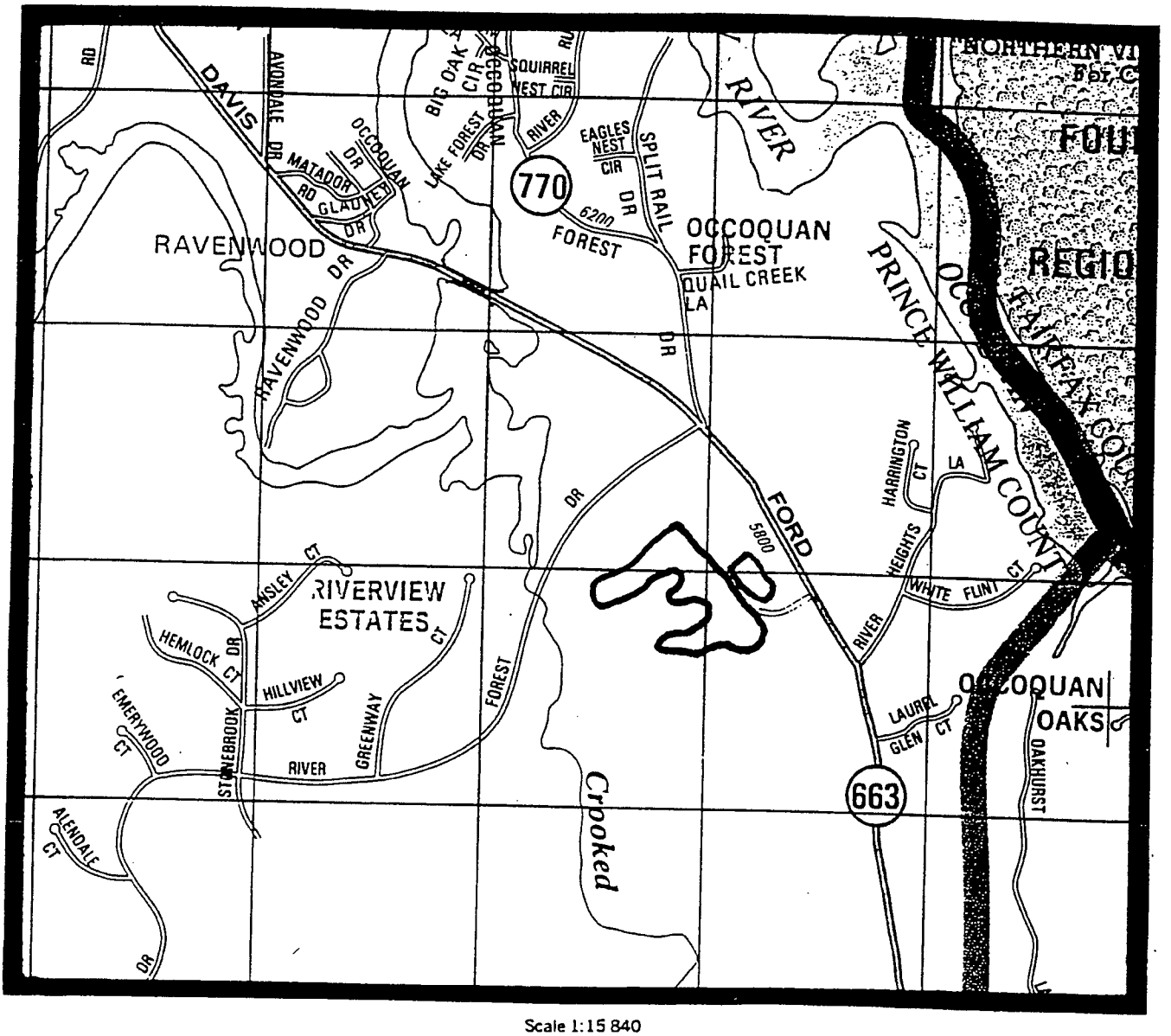
MANASSAS
MANASSAS PARK
CENTREVILLE
FAIRFAX
CLIFTON
BURKE
VIENNA
CHANTILLY
QUANTICO MARINE CORPS BASE
(COMBAT DEVELOPMENT COMMAND)
PRINCE WILLIAM FOREST PARK
QUANTICO
DUMFRIES
WOODBRIDGE
OCCOQUAN
LAKE RIDGE
BRISTOW
NOKESVILLE
GAINESVILLE
SOMERVILLE
TY, VA
ic., 6440
/A 22312-

Environmental Agronomics



LOCATION MAP

Prince William County Service Authority
Occoquan Forest STP
Land Treatment System

N

VIRGINIA POLLUTION ABATEMENT APPLICATION

FORM D

MUNICIPAL EFFLUENT AND BIOSOLIDS

PART D-I LAND APPLICATION OF MUNICIPAL EFFLUENT

General Information

1. Facility Name. Name given on Form A. **Occoquan Forest Wastewater Treatment Plant: VPA 00007**

2. Briefly describe the design and provide a line drawing of the wastewater treatment facility which relates the various components of the treatment system including source(s), treatment unit(s) disposal alternatives and flow estimates from the various process units. **Attachment 2**

3. Briefly describe the disposal of any solid or sludge waste materials. **Attachment 2**

4. List all industrial contributors to the wastewater treatment facility. **N/A**

5. Submit a copy of any leasing agreements related to the treatment works and the use or management of the application fields not under direct ownership of the applicant. **N/A**

6. All Privately Owned Treatment Works (PVOTW) designed to serve 50 or more residences must be registered with the State Corporation Commission (SCC) prior to applying for a permit. Provide a copy of the SCC Certificate of Incorporation (for Virginia based operations) or the Certificate of Authority (for out of state operations) with the application. **N/A**

Design Information

Note: This section should be completed for each alternative effluent application system.

Waste Characterization

7. Provide the design flow of the wastewater treatment plant. **Attachment 2**

8. Provide a sewage effluent characterization in accordance with Part D-III of the application. For a proposed facility, estimates based on data obtained from other similar facilities may be used. More than one sample may be required if the effluent may be expected to exhibit diurnal or seasonal variation.
Attachment 3 – Part D Effluent Characterization Form

9. Provide calculations describing the nutrient value of the effluent as mg/l nitrogen (PAN), phosphorus (P_2O_5), potassium (K_2O) and any liming effects which may occur from land application. **Attachment 4 - Nutrients**

Storage and Land Application Requirements **Attachment 5 – Storage and Land Application Requirements**

10. Provide calculations justifying storage and land area requirements for wastewater application including an annual water balance on a monthly basis incorporating such factors as precipitation, evaporation, evapotranspiration, soil hydraulic conductivity, wastewater loading, dry periods, and monthly storage (input and drawdown). Provide daily, weekly and annual hydraulic loading rates (maximum and average).

    All facilities must be designed and operated to prevent any discharge to State waters except in the event of a 25 year, 24 hour or greater storm event. DEQ recommends the storage capacity be sufficient to store the entire daily design flow of the treatment works for the duration of the winter months, when land application may be restricted, with a minimum of 60 days storage capacity where adequate climatological data are not available.

11. Provide calculations justifying the land area requirements for land application of sewage effluent taking into consideration average productivity group, crop(s) to be grown and most limiting factor(s), specifically PAN, metal loadings, and Sodium Adsorption Ratio (SAR) or Exchangeable Sodium, where applicable. Demonstrate the most limiting factor for land application on an annual and site life basis.

Site Characterization: Attachment 6

Note: A site characterization is required for each land application site on a field by field basis and for each storage facility. Site booklets organized by Operator/Land Owner and County are preferred.

Divide the land application site into individualized units of fields on the basis of agronomic management practices. For example, soils which are similar for productivity or pH adjustment which are adjacent to each other should be grouped as one field if they can be anticipated to receive effluent on similar schedules. Distinctly different soils which may require different agronomic management should be designated separately. For convenience in meeting permit reporting requirements, keep field units small.

12. Provide a general location map which clearly indicates the location of all the land application sites related to this permit application. (See General Instructions for Map Requirements.)

13. Provide a topographic map of sufficient scale (5 foot contour preferred) clearly showing the location of the following features within 0.25 mile of the site. More than one map may be required if the land application site(s) or treatment/storage facilities are not in close proximity. Provide a legend and approximate scale. Clearly mark field and property boundaries. (See Instructions for map requirements.) **Attachment 6**

    a. Proposed or existing ground water monitoring wells
    b. General direction of ground water movement
    c. Water wells, abandoned or operating
    d. Surface waters
    e. Springs **N/A**
    f. Public water supply(s) **N/A**
    g. Sinkholes **N/A**
    h. Underground and/or surface mines **N/A**
    i. Mine pool (or other) surface water discharge points **N/A**
    j. Mining spoil piles and mine dumps **N/A**
    k. Quarry(s) **N/A**
    l. Sand and gravel pits **N/A**
    m. Gas and oil wells **N/A**
    n. Diversion ditch(s) **N/A**
    o. Agricultural drainage ditch(s) **N/A**
    p. Occupied dwellings, including industrial and commercial establishments **N/A**
    q. Landfills or dumps **N/A**
    r. Other unlined impoundments **N/A**
    s. Septic tanks and drainfields **N/A**
    t. Injection wells **N/A**
    u. Rock outcrops **N/A**

14. For each land application site, provide a site plan, preferably topographically based, of sufficient detail to clearly show any landscape features which require buffer zones or may limit land application. Clearly show the field boundaries, property lines, and the location of any subsurface agricultural drainage tile, as appropriate.
    Attachment 6

    Provide a site plan legend which identifies the following landscape features:
    a. Drainage ways
    b. Rock outcrops **N/A**
    c. Sink holes **N/A**
    d. Drinking water wells and springs **N/A**
    e. Monitoring wells

f. Property lines
g. Roadways **N/A**
h. Occupied dwellings **N/A**
i. Slopes (greater than 8% by slope class)
j. Wet spots **N/A**
k. Severe erosion **N/A**
l. Frequently flooded soils (SCS designation) **N/A**
m. Surface waters

15. Provide a detailed soil survey map, preferably photographically based, with the field boundaries clearly marked. (A USDA-SCS soil survey map should be provided, if available.)

    Attachment 7

    Provide a detailed legend for each soil survey map which uses accepted USDA-SCS descriptions of the typifying pedon for each soil series (soil type). Complex associations may be described as a range of characteristics. Soil descriptions should include the following information:

    a. Soil symbol
    b. Soil series, textural phase and slope class
    c. Depth to seasonal high water table
    d. Depth to bedrock
    e. Estimated productivity group (for the proposed crop rotation).
    f. Estimated infiltration rate (surface soil)
    g. Estimated permeability of most restrictive subsoil layer

16. Representative soil borings and test pits to a depth of five feet or to bedrock if shallower, are to be coordinated for the typifying pedon of each soil series (soil type). Soil descriptions shall include as a minimum the following information:

    Attachment 7

    a. Soil symbol
    b. Soil series, textural phase and slope class
    c. Depth to seasonal high water table
    d. Depth to bedrock
    e. Estimated productivity group (for the proposed crop rotation).
    f. Estimated infiltration rate (surface soil)
    g. Estimated permeability of most restrictive subsoil layer

17. Collect and analyze soil samples for the following parameters for each field, weighted to best represent each of the soil borings performed for Item I6.

    Attachment 8

    a. Soil organic matter (%)
    b. Soil pH (std. units)
    c. Cation exchange capacity (meg/l00g)
    d. Total nitrogen (ppm)
    e. Organic nitrogen (ppm)
    f. Ammonia nitrogen (ppm)
    g. Nitrate nitrogen (ppm)
    h. Available phosphorus (ppm)
    i. Exchangeable sodium (mg/l00g)
    j. Exchangeable calcium (mg/l00g)
    k. Copper (ppm)
    l. Nickel (ppm)
    m. Zinc (ppm)
    n. Cadmium (ppm)
    o. Lead (ppm)
    p. Chromium (ppm)
    q. Manganese (ppm)
    r. Particle size analysis or USDA textural estimate (%)
    s. Hydraulic conductivity (in/hr.)

Crop and Site Management

18. Relate the crop nutrient needs to anticipated yields, soil productivity rating and the various fertilizer or nutrient sources from effluent and chemical fertilizers.

Attachment 9

If the effluent may be expected to possess unusual properties, provide a description of any plant tissue testing, supplemental fertilization or intensive agronomic management practices which may be necessary.

19. Using a narrative format and referencing any related charts, describe the proposed cropping system. Show how the crop rotation and management will be coordinated with the design of the land application system. Include any supplemental fertilization program, and the coordination of tillage practices, planting and harvesting schedules and timing of land application.

Attachment 9

ATTACHMENT 2

PART D-1, ITEMS 1 THROUGH 7
GENERAL INFORMATION

Occoquan Forest Wastewater Treatment Plant

Process Description and Operation

The Prince William County Service Authority owns and operates the Occoquan Forest Wastewater Treatment Plant. This wastewater treatment facility is designed to provide service to 220 single family residential homes within the Occoquan Forest subdivision. No industrial or commercial waste is treated.

The attached process flow diagram describes the sequence of treatment. Raw wastewater (sewage) enters an extended aeration activated sludge plant having a capacity of 88,000 GPD (0.088 MGD). The plant consists of two Davco package plants, each with a capacity of 44,000 GPD. Clarified secondary effluent is metered and chlorinated before entering a 4.7 MG holding pond. Holding pond effluent is metered, chlorinated and pumped to a 14.3 acre spray irrigation system for effluent disposal.

Aerobically digested waste activated sludge is hauled to the Neabsco Pump Station or directly to the H.L. Mooney Advanced Water Reclamation Facility where solids are disposed of by incineration. Incinerated ash is hauled to Prince William County Landfill.

The Occoquan Forest Treatment Plant is serviced 7 days per week by operation personnel, one of whom holds a VA Wastewater Operators License.

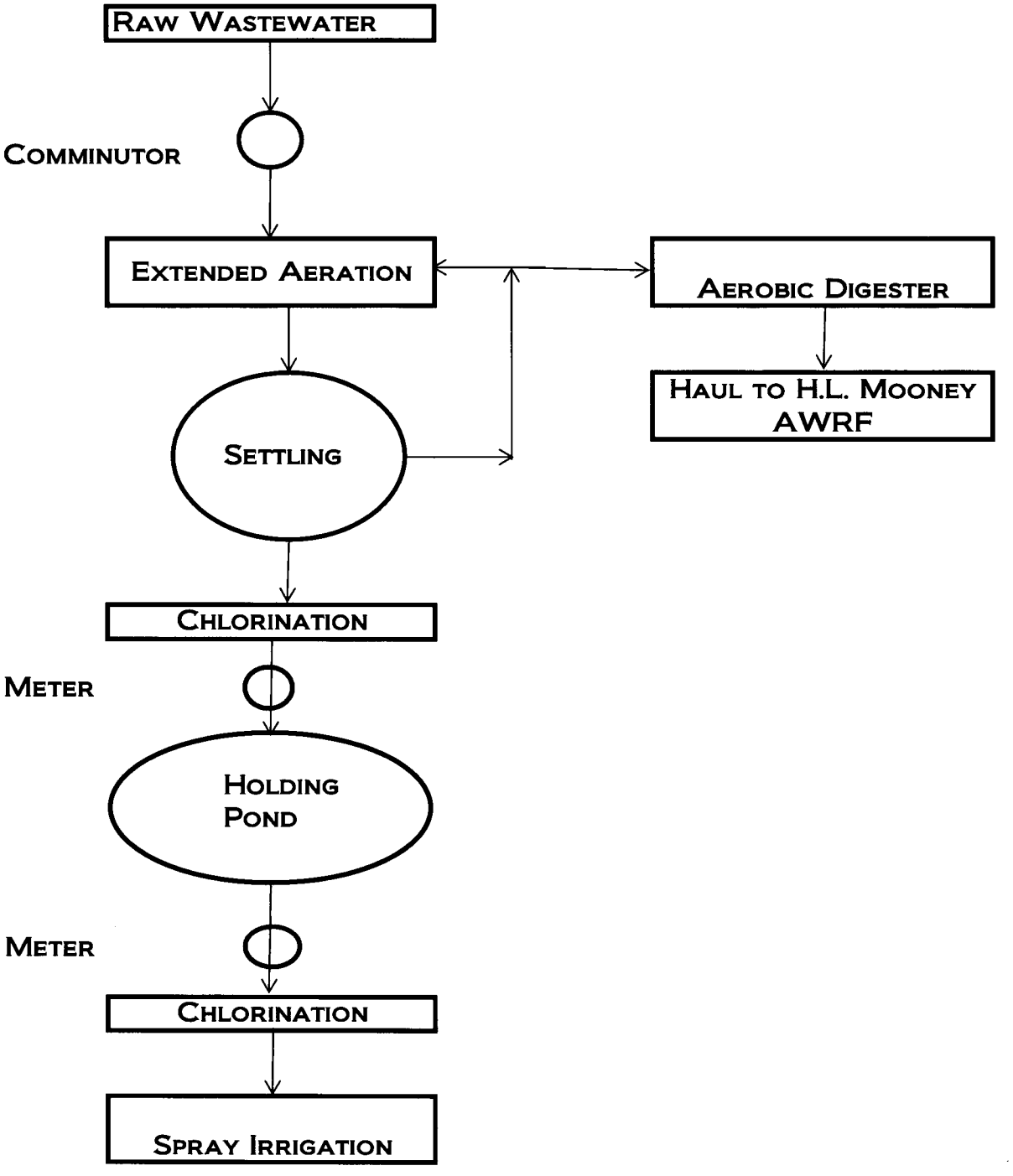
Liquid Treatment:

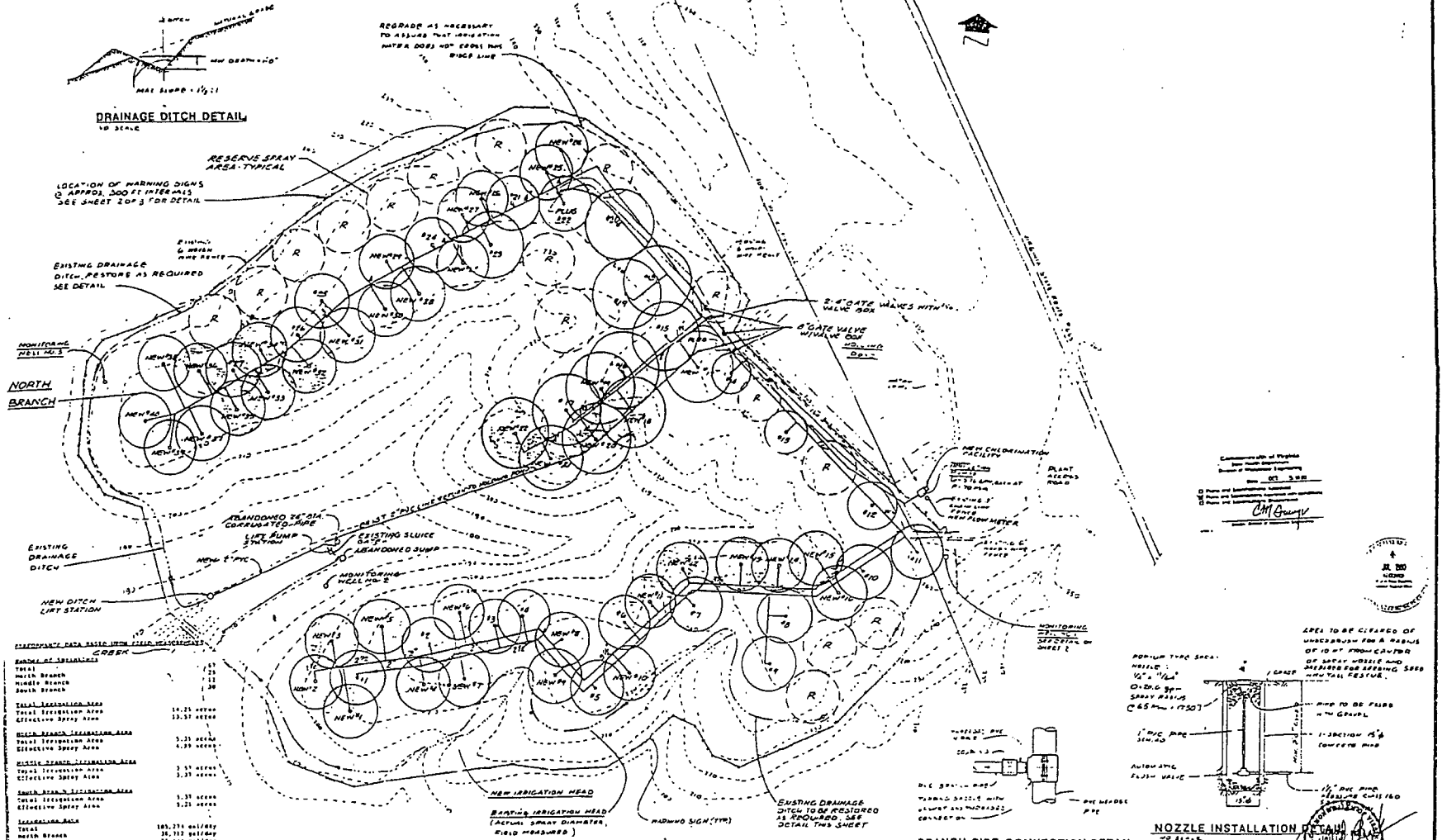
Preliminary Treatment (Communitor) ⟶ Extended Aeration Activated Sludge ⟶ Secondary Clarification ⟶ Metering and Chlorination ⟶ Polishing / Holding Pond ⟶ Metering and Chlorination ⟶ Spray Irrigation

Solids Treatment

Waste Activated Sludge ⟶ Aerobic Digestion ⟶ Haul to H.L. Mooney AWRF for Treatment and Incineration

Occoquan Forest WTP





Rezek, Henry, Meisenheimer, and Gende, Inc. — Libertyville, Illinois

Occoquan Forest Water And Sewer Company

Job No. 77013
Date June, 1985

1of3

VIRGINIA POLLUTION ABATEMENT APPLICATION

FORM D

MUNICIPAL EFFLUENT AND BIOSOLIDS

PART D-III EFFLUENT CHARACTERIZATION FORM

1. Facility Name: Occoquan Forest Wastewater Treatment Plant

2. Source or Generator: N/A

3. Type of Treatment: Secondary / Extended Aeration : Spray Irrigation

4. Degree of Treatment: 90%

5. Provide at least one analysis for each parameter listed under effluent. Upon review, additional analyses may be required by DEQ. **CY-2014 Data Attached – 3 pages**

Parameter	Effluent	
BOD_5	6.6	mg/l
TSS	4.8	mg/l
TRC	4.0	mg/l
Percent Solids	N/A	%
pH	7.4	S.U.
Nitrogen, (Nitrate)	13.5	mg/l
Nitrogen, (Ammonium)	11.9	mg/l
Nitrogen, (Total Kjeldahl)	11.5	mg/l
Phosphorus, (Total)	5.7	mg/l
Potassium, (Total)	12	mg/l
Sodium	103	mg/l

6. Provide at least one analysis of any other pollutants which you believe may be present in the effluent. Upon review, additional analyses may be required by DEQ. **CY-2014 Data Attached – 3 pages**

Parameter	Effluent	
Lead	<0.005	mg/l
Cadmium	<0.0025	mg/l
Copper	<0.05	mg/l
Nickel	<0.05	mg/l
Zinc	<0.05	mg/l
Other	**See Attached**	mg/l

VPA MONITORING REPORT - Occoquan Forest WWTP
VPA Permit No. VPA0007

FORM 1 - Page 1 of 3

Wastewater Monitoring
LOCATION: Before Holding Pond

Parameter	Influent Flow to Pond (1)	BOD_5	TSS	TRC	Fecal Coliform	pH	Alkalinity as $CaCO_3$	Conductivity
Limit	NL	30 MonthlyAverage / 60 Maximum	30 MonthlyAverage / 60 Maximum	(2)	200/100 ml	6.0 - 9.0	NL	NL
Unit	MGD	ppm	ppm	ppm	n/100ml	S.U.	ppm	µmho/cm
Frequency	Continuous	2/Month	2/Month	1/Day	1/Month	1/Day	1/Month	1/Month
Sample Type	Totalizing, Indicating	Grab	Grab	Grab	Grab	Grab	Grab	Grab
Required Reporting	1/Month	1/Month	1/Month	1/Month	1/Month	1/Month	1/Month	1/Month
January	0.095	6.5/10.0	1.6/1.7	5.0	32.0	7.0/7.7	288	969
February	0.091	10.0/11.0	13.7/16.4	6.2	56.0	7.2/7.6	170	704
March	0.131	11.5/15.0	13.1/21.4	5.8	110.0	7.4/7.7	247	921
April	0.222	2.5/3.0	2.0/2.3	3.1	2.0	7.0/7.5	147	624
May	0.081	4.0/5.0	1.7/3.4	2.0	130.0	6.7/7.4	73	762
June	0.032	2.5/3.0	0.8/1.5	4.2	9.0	7.3/7.8	255	944
July	0.040	13.5/23.0	3.6/4.8	4.3	1.8	7.1/7.4	153	957
August	0.045	3.5/4.0	2.9/3.1	3.1	11.0	6.9/7.7	145	857
September	0.032	1.5/3.0	1.4/2.7	3.8	4.0	7.1/7.9	137	853
October	0.028	3.5/4.0	2.3/2.5	3.2	130.0	7.0/8.1	127	815
November	0.073	3.5/4.0	2.7/5.3	5.0	170.0	6.8/7.8	82	852
December	0.061	4.5/7.0	2.3/2.5	2.2	175.0	6.7/7.8	109	786

VPA MONITORING REPORT - Occoquan Forest WWTP
VPA Permit No. VPA0007

FORM 1 - Page 2 of 3

Wastewater Monitoring
LOCATION: Before Holding Pond

Parameter	NH_3-N	NO_3-N	TKN	Total Phosphorus	Total Potassium	Total Sodium	Total Calcium	Total Magnesium	Sodium Absorption Ratio	Boron (3)
Limit	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL
Unit	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	NA	ppm
Frequency	1/Month	1/Month	1/Month	1/Month	1/Month	1/Month	1/Month	1/Month	1/Month	1/3 Years
Sample Type	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Calculated	Grab
Required Reporting	1/Month	1/Month	1/Month	1/Month	1/Month	1/Month	1/Month	1/Month	1/Month	1/3 Years
January	30.50	0.57	31.00	5.52	11.10	102.00	40.70	6.20	3.92	NA
February	9.90	0.40	17.00	2.51	6.99	74.20	31.80	4.69	3.25	NA
March	28.50	<0.25	29.60	4.02	11.40	92.90	35.90	6.29	3.74	NA
April	10.90	2.76	12.40	2.03	7.30	73.80	27.00	4.70	3.45	NA
May	5.00	27.40	2.84	4.81	12.60	94.40	35.60	6.33	3.83	NA
June	18.50	0.28	28.40	4.48	12.20	108.00	36.00	6.27	4.36	NA
July	1.23	11.90	3.67	4.56	12.70	153.00	38.60	5.83	6.06	NA
August	1.83	18.10	4.14	6.76	15.20	118.00	38.30	6.41	4.63	NA
September	<0.20	11.60	1.22	6.47	13.30	119.00	34.70	6.01	4.88	NA
October	<0.20	23.10	2.20	6.49	13.90	104.00	38.10	6.29	4.11	0.251
November	<0.20	37.60	2.31	7.56	15.10	105.00	40.50	6.57	4.01	NA
December	0.68	15.10	2.10	13.00	12.80	96.90	41.80	6.56	3.66	NA

VPA MONITORING REPORT - Occoquan Forest WWTP
VPA Permit No. VPA0007

FORM 1 - Page 3 of 3

Wastewater Monitoring
LOCATION: Before Holding Pond

Parameter	Chloride (3)	Molybdenum (3)	Copper (3)	Cobalt (3)	Iron (3)	Manganese (3)	Nickel (3)	Zinc (3)
Limit	NL	NL	NL	NL	NL	NL	NL	NL
Unit	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Frequency	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/3 Years
Sample Type	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
Required Reporting	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/3 Years
October-11	139	<0.05	<0.05	<0.05	0.060	<0.05	<0.05	<0.05
October-12	170	<0.05	<0.05	<0.05	0.068	<0.05	<0.05	<0.05
October-13	142	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
October-14	91.8	<0.05	<0.05	<0.05	<0.055	<0.05	<0.05	<0.05

(1) Influent flow to be measured after all treatment and prior to holding pond storage

(2) No more than three TRC samples taken after the chlorine contact tank and prior to storage shall be less than 1.0 mg/l for any calandar month, and no TRC sample shall be less than 0.6 mg/l.

(3) Sampling for micronutrients in the wastewater shall be conducted triennially in October in conjunction with soil sampling. If elevated levels of micronutrients are observed during soil sampling, micronutrient sampling should be increased to an annual frequency. Metals are to be reported as total recoverable.

Legend: NL = No Limit (monitoring requirement only)

Analytics Corporation
10329 Stony Run Lane
Ashland, VA 23005
Phone: (804) 365-3000
Fax: (908) 365-3002

ANALYTICAL RESULTS

Workorder: 1025744 OCCOQUAN FOREST FINAL EFFLUEN

Lab ID: 1025744001 Date Received: 03/30/2015 8:37 Matrix Aqueous Liquid
Sample ID: 15032504-31 Date Collected: 03/26/2015 8:00 Sample Type: GRAB

Parameters	Results	Units	Report Lim	DF	Prepared	By	Analyzed	By	Qual	Certifications
Analytical Method: EPA 200.8					Preparation Method: EPA 200.8					
Cadmium	<0.00250	mg/L	0.0025	1	03/31/2015	08:40 JRM	3/31/2015	16:32 HB		V
Lead	<0.00500	mg/L	0.0050	1	03/31/2015	08:40 JRM	3/31/2015	16:32 HB		V

Analytics Corporation
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Ashland, VA 23005
Phone: (804) 365-3000
Fax: (908) 365-3002

ANALYTICAL RESULTS

Workorder: 1025744 OCCOQUAN FOREST FINAL EFFLUEN

Qualifiers

-

Certification Index:

V = Virginia (NELAC) - 1 VAC 30-46 H 1, Laboratory ID: 460160, Certificate #: 7668

ATTACHMENT 4

PART D-1, ITEM 9, CALCULATIONS DESCRIBING NUTRIENT VALUE

Environmental Agronomics

Prince William County Service Authority
Occoquan Forest STP

Summary
Wastewater Nutrients

2014

Month	TKN	NO_3-N	NH_3-N	PO_4	K	Ca	Mg	Na
January	31.00	0.57	30.50	5.52	11.10	40.70	6.20	102.00
February	17.00	0.40	9.90	2.51	6.99	31.80	4.69	74.20
March	29.60	<0.25	28.50	4.02	11.40	35.90	6.29	92.90
April	12.40	2.76	10.90	2.03	7.30	27.00	4.70	73.80
May	2.84	27.40	5.00	4.81	12.60	35.60	6.33	94.40
June	28.40	0.28	18.50	4.48	12.20	36.00	6.27	108.00
July	3.67	11.90	1.23	4.56	12.70	38.60	5.83	153.00
August	4.14	18.10	1.83	6.76	15.20	38.30	6.41	118.00
September	1.22	11.60	<0.20	6.47	13.30	34.70	6.01	119.00
October	2.20	23.10	<0.20	6.49	13.90	38.10	6.29	104.00
November	2.31	37.60	<0.20	7.56	15.10	40.50	6.57	105.00
December	2.10	15.10	0.68	13.00	12.80	41.80	6.56	96.90
Average	**11.41**	**13.53**	**11.89**	**5.68**	**12.05**	**36.58**	**6.01**	**103.43**

All values are reported as mg/l

Environmental Agronomics

Prince William County Service Authority
Occoquan Forest STP

Summary
Wastewater Nutrient Addition
Nitrogen-Phosphorus-Potassium
Pounds Per Acre Applied

2014

Nutrient	South (Upper) SF 3	Middle SF 2	North (Lower) SF 1
Plant Available Nitrogen (PA-N)	**74.09**	**9.24**	**80.33**
Phosphorus (PO_4)	**35.50**	**4.41**	**38.38**
Potassium	**75.08**	**9.36**	**81.41**

The PA-N is reported as a total of the monthly additions of PA-N in the wastewater divided by the monthly average percentage of water applied to each spray field. The PA-N is calculated each month using the monthly results of the Nitrogen found in the wastewater.

The phosphorus and potassium totals are calculated using the 2014, twelve (12) month average found on the previous page containing the Wastewater Nutrient Addition Summary.

VPA MONITORING REPORT - Occoquan Forest WWTP
VPA Permit No. VPA0007

FORM 2 - Page 1 of 3

Land Application
LOCATION: Holding Pond/Application Sites

Parameter	No. of Acres Irrigated	Zones Applied (Designate Areas) (1)	Irrigation Rate (2, 3, 4)	Effluent Flow (Effluent Vol. Applied from Storage to Area) (2, 3, 4)	Total Volume Applied to North Branch Irrigation Area (2, 3, 4, 5)
Limit	NA	NA	(4)	NL	NL
Unit	Acres	NA	In/Mon/Acre	Gal/Site/Month	In/Mon/Acre
Frequency	1/Month	1/Month	1/Month	1/Month	1/Month
Sample Type	Measured	Measured	Calculated	Measured	Calculated
Required Reporting	1/Month	1/Month	1/Month	1/Month	1/Month
January	14.3	1, 2, & 3	0.28	107965.00	0.00
February	14.3	1, 2, & 3	0.00	0.00	0.00
March	14.3	1, 2, & 3	1.13	436962.00	2.10
April	14.3	1, 2, & 3	4.34	1685679.00	4.85
May	14.3	1, 2, & 3	2.79	1084073.00	4.55
June	14.3	1, 2, & 3	3.25	1260081.00	3.83
July	14.3	1, 2, & 3	3.59	1394613.00	4.40
August	14.3	1, 2, & 3	1.59	615834.00	0.82
September	14.3	1, 2, & 3	2.29	887486.00	5.10
October	14.3	1, 2, & 3	1.11	432345.00	1.98
November	14.3	1, 2, & 3	0.00	0.00	0.00
December	14.3	1, 2, & 3	1.91	741356.00	2.20

VPA MONITORING REPORT - Occoquan Forest WWTP
VPA Permit No. VPA0007

FORM 2 - Page 2 of 3

Land Application
LOCATION: Holding Pond/Application Sites

Parameter	Total Volume Applied to Middle Branch Irrigation Area (2, 3, 4, 5)	Total Volume Applied to South Branch Irrigation Area (2, 3, 4, 5)	Rainfall (6)	Evapotranspiration Rate (6)	Volume In Storage (7)
Limit	NL	NL	NA	NA	NL
Unit	Inches/Month/Acre	Inches/Month/Acre	Inches/Month	Inches/Month	Million Gallons
Frequency	1/Month	1/Month	1/Day	1/Week	1/Month
Sample Type	Calculated	Calculated	Measured	Estimated	Measured
Required Reporting	1/Month	1/Month	1/Month	1/Month	1/Month
January	0.00	0.74	3.30	0.04	3.68
February	0.00	0.00	4.30	0.10	4.05
March	0.00	0.92	6.30	0.74	4.05
April	0.77	6.25	9.30	2.05	3.03
May	0.00	2.93	5.70	3.70	2.75
June	0.00	4.85	3.20	5.23	1.95
July	1.62	4.13	6.90	6.21	1.33
August	0.00	3.42	6.80	5.59	1.39
September	0.57	0.66	2.90	3.87	1.09
October	0.00	1.01	4.00	2.04	1.63
November	0.00	0.00	3.90	0.81	2.07
December	0.47	2.59	5.80	0.16	2.20

VPA MONITORING REPORT - Occoquan Forest WWTP
VPA Permit No. VPA0007

FORM 2 - Page 3 of 3

Land Application
LOCATION: Holding Pond/Application Sites

Parameter	Lagoon Freeboard	Effluent PAN Applied	Other N Applied (Fertilizer, etc.)	Total PAN Applied YTD	Total Residual Chlorine
Limit	2 Feet Minimum	(8)	(8, 9)	(8)	2.0 mg/l
Unit	Feet	Pounds/Acre/Month	Pounds/Acre/Month	Pounds/Acre	Inches/Month
Frequency	1/Month	1/Month	1/Month	1/Month	1/Day
Sample Type	Measured	Calculated	Measured	Calculated	Measured
Required Reporting	1/Month	1/Month	1/Month	1/Month	1/Month
January	2.42	0.88	0.00	0.88	3.40
February	2.16	0.00	0.00	0.88	0.00
March	2.42	3.93	0.00	4.81	2.70
April	2.67	14.30	0.00	19.10	2.10
May	3.17	5.05	0.00	24.20	2.10
June	4.33	3.22	0.00	27.40	2.20
July	5.08	7.40	0.00	34.80	2.80
August	6.25	2.48	0.00	37.30	2.90
September	6.08	1.78	0.00	39.10	2.70
October	6.08	3.12	0.00	42.20	3.00
November	5.33	0.00	0.00	42.20	0.00
December	4.80	6.36	0.00	48.60	2.80

ATTACHMENT 5

PART D-1, ITEMS 10 AND 11, STORAGE AND LAND APPLICATION REQUIREMENTS

Environmental Agronomics

Occoquan Forest STP

Calculations

Plant Design/Permitted Flow Capacity

88,000 Gallons Per Day (GPD)
36.25 Inches Average Rainfall
37.00 Inches Average Evaporation
14.25 Acres – Total Irrigation Area
13.57 Acres – Effective Spray Area

365 Days/Year x 88,000 GPD = 32,120,000 Gallons Per Year
32,120,000 GPY ÷ 27,154 Gallons Per acre Inch of Water = 1,182.9 AI

1,182.9 Total AI of Water ÷ 14.25 Total Acres = 83.0 AI/Year
1,182.9 Total AI of Water ÷ 13.57 Spray Acres = 87.2 AI/Year

83.0 AI/Acre ÷ 52 Weeks Per year = 1.60 AI/Week of Water
87.2 AI/Acre ÷ 52 Weeks Per year = 1.68 AI/Week of Water

36.25 AI/Acre Annual Rainfall – 102% Evaporation = - 0.75 AI/Acre
÷ 52 Weeks Per Year = 0.01 AI/Week Net Loss of Rain Water

1.68 AI/Week + (-0.01) AI/Week = **1.67 AI/Week** to operate the Spray System at Design/Permitted Flow (Includes Rain water Addition).

Environmental Agronomics

Occoquan Forest STP

Calculations

Plant Average Daily Flow
[Last Five (5) Year Average]

42,163 Gallons Per Day (GPD)
36.25 Inches Average Rainfall
37.00 Inches Average Evaporation
14.25 Acres – Total Irrigation Area
13.57 Acres – Effective Spray Area

365 Days/Year x 42,163 GPD = 15,389,426 Gallons Per Year
15,389,426 GPY ÷ 27,154 Gallons Per acre Inch of Water = 566.7 AI

566.7 Total AI of Water ÷ 14.25 Total Acres = 39.8 AI/Year
566.7 Total AI of Water ÷ 13.57 Spray Acres = 41.8 AI/Year

39.8 AI/Acre ÷ 52 Weeks Per year = 0.77 AI/Week of Water
41.8 AI/Acre ÷ 52 Weeks Per year = 0.80 AI/Week of Water

36.25 AI/Acre Annual Rainfall – 102% Evaporation = - 0.75 AI/Acre
÷ 52 Weeks Per Year = 0.01 AI/Week Net Loss of Rain Water

0.80 AI/Week + (-0.01) AI/Week = **0.79 AI/Week** to operate the Spray System at Actual Average Flow (Includes Rain water Addition).

Environmental Agronomics

Design Flow

Calculations

for the

Storage Facility

- 4,945,600 Gallons Storage Capacity
- 32,120,000 GPY Design Capacity
- Design Capacity = 56.2 Days Storage

If the storage facility were used for the maximum amount of time during inclement weather, then the total gallons (32,120,000) for the year would be sprayed during 308.8 (365-56.2) days of the year rather than the full calendar year of 365 days.

- 32,120,000 ÷ 308.8 days = 104,015 Gallons/Day Sprayed
- 104,015 GPD ÷ 27,154 Gallons/Acre Inch = 3.83 AI/Day
- 3.83 AI/Day ÷ 13.57 Spray Acres = 0.282 AI/Acre/Day
- 0.282 AI/Acre/Day x 7 Days/Week = 1.97 AI/Week for the spray area
- 0.282 AI/Acre x 27,154 Gallons/Acre Inch = 7,657 Gallons/Day/Acre

Using the pump operating ranges of 308 GPM to 538 GPM, the spray time needed to apply the 7,657 GPA would range from less than 15 minutes to 25 minutes per day. The most restrictive soil zone has a permeability range of 0.6-6.0 inches per hour. The **0.282** AI of spray water is less than ½ of the water quantity, which the most restrictive layer of soil can handle. Even when the rainwater is added into the calculations, it will not impact the ability of the soil to handle the total amount on a daily basis. By operating each of the three (3) sections of the spray field on a rotation of once every three (3) days at **0.85** AI/Day of spraying (spray one day and rest two days), we have the capacity to spray the actual average flow using the current storage capacity. We will operate the spray system at a rate so as not to exceed 0.25 AI/hour sprayed. With this in mind, no more than just over 3.4 hours per day is needed to apply the actual average flow rate. This is an ideal situation, which we all know does not exist. Therefore, we will operate the spray system more than the 3.4 hours per day at times when operating our facility.

Environmental Agronomics

Actual Average Flow

Calculations

for the

Storage Facility

- 4,945,600 Gallons Storage Capacity
- 15,389,426 GPY Average Flow for Previous Five (5) Years
- Current Average Flow Rate = 117.3 Days Storage

If the storage facility were used for the maximum amount of time during inclement weather, then the total gallons (15,389,426) actual average flow for the year would be sprayed during 247.7 (365-117.3) days of the year rather than the full calendar year of 365 days.

- 15,389,624 ÷ 247.7 days = 62,130 Gallons/Day Sprayed
- 62,130 GPD ÷ 27,154 Gallons/Acre Inch = 2.29 AI/Day
- 2.29 AI/Day ÷ 13.57 Spray Acres = 0.169 AI/Acre/Day
- 0.169 AI/Acre/Day x 7 Days/Week = 1.18 AI/Week for the spray area
- 0.169 AI/Acre x 27,154 Gallons/Acre Inch = 4,589 Gallons/Day/Acre

Using the pump operating ranges of 308 GPM to 538 GPM, the spray time needed to apply the 4,589 GPA would range from less than 10 minutes to 15 minutes per day. The most restrictive soil zone has a permeability range of 0.6-6.0 inches per hour. The 0.169 AI of spray water is less than 1/3 of the water quantity, which the most restrictive layer of soil can handle. Even when the rainwater is added into the calculations, it will not impact the ability of the soil to handle the total amount on a daily basis. By operating each of the three (3) sections of the spray field on a rotation of once every three (3) days at **0.51** AI/Day of spraying (spray one day and rest two days), we have the capacity to spray the actual average flow using the current storage capacity. We will operate the spray system at a rate so as not to exceed 0.25 AI/hour sprayed. With this in mind, no more than just over 2 hours per day is needed to apply the actual average flow rate. This is an ideal situation, which we all know does not exist. Therefore, we will operate the spray system more than the 2 hours per day at times when operating our facility.

Environmental Agronomics

Occoquan Forest STP

Spray Water from Storage Lagoon

Available Nutrients

Design Flow

32,120,000 Gallons per Year Applied

Nitrogen =	7.41 mg/l TKN	32.12 MG x 8.34 #/G H_2O x 7.41 =	1985.0 lbs.
	3.14 mg/l NH_3	32.12 MG x 8.34 #/G H_2O x 3.14 =	841.1 lbs.
	4.27 mg/l Org N	32.12 MG x 8.34 #/G H_2O x 4.27 =	1143.6 lbs.
	0.61 mg/l NO_3	32.12 MG x 8.34 #/G H_2O x 0.61 =	163.4 lbs.
Phosphorus =	2.70 mg/l PO_4	32.12 MG x 8.34 #/G H_2O x 2.70 =	723.3 lbs.
Potassium =	10.89 mg/l K	32.12 MG x 8.34 #/G H_2O x 10.89 =	2917.2 lbs.

Total Available Nitrogen (PA-N)

1143.60 lbs. Organic Nitrogen
0.30 % Mineralization
343.08 lbs. Available Organic Nitrogen
420.55 lbs. Ammonia Nitrogen
163.40 lbs. Nitrate Nitrogen
927.03 lbs. Total Nitrogen
185.41 lbs. Denitrification (20 % loss)

741.62 lbs. Total PA-N

Total Residual Nitrogen from Previous Years Application

2nd year mineralization @ 0.15 availability	=	120.08 lbs.
3rd year mineralization @ 0.08	=	54.44 lbs.
4th year mineralization @ 0.04	=	25.04 lbs.
5th year mineralization @ 0.04	=	24.04 lbs.
6th year mineralization @ 0.04	=	23.08 lbs.
7th year mineralization @ 0.04	=	22.15 lbs.
8th year mineralization @ 0.04	=	21.27 lbs.
9th year mineralization @ 0.04	=	20.42 lbs.
10th year mineralization @ 0.04	=	19.60 lbs.
		330.12 lbs.

741.62 + 330.12 = 1,071.74 lbs. Total Nitrogen ÷ 13.57 Acres = 78.98 # N/Acre

Environmental Agronomics

Occoquan Forest STP

Annual Averages

Nutrients Applied
(mg/l)

Year	TKN	NO_3	NH_4	PO_4	K
1995	6.29	1.00	1.68	2.11	8.66
1996	7.48	0.52	2.69	2.12	7.13
1997	5.07	1.60	0.56	2.02	8.72
1998	5.63	0.90	1.81	2.73	10.72
1999	6.89	0.53	1.73	2.37	11.63
2000	6.76	0.65	1.88	3.38	10.95
2001	8.57	0.82	4.25	3.14	11.46
2002	7.50	0.66	3.41	2.46	12.48
2003	7.32	0.36	4.45	2.16	7.92
9 year average (1995-2003)	**6.83**	**0.78**	**2.50**	**2.50**	**9.96**
5 year average (1999-2003)	**7.41**	**0.61**	**3.14**	**2.70**	**10.89**

Environmental Agronomics

Schedule

Effluent Spray Events

Design Flow

North Field	**Middle Field**	**South Field**
4.99 Acres	3.37 Acres	5.21 acres
x 0.85 AI/Day	x 0.85 AI/Day	x 0.85 AI/Day
4.2415 AI	2.8645 AI	4.4285 AI
x 27.154 G/AI	x 27.154 G/AI	x 27.154 G/AI
115,174 G/Field	**77,783** G/Field	**120,251** G/Field

Spraying will occur 44.1 weeks per year when 56.2 days of storage is used. Each weekly spray schedule will occur 14.7 weeks per year.

Weeks Occurring	**Weeks Occurring**	**Weeks Occurring**
1, 4, 7, 10, 13, 16, 19, 22, 25, 28, 31, 34, 37, 40, 43	2, 5, 8, 11, 14, 17, 20, 23, 26, 29, 32, 35, 38, 41, 44	3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42

Day	**Gallons**	**Day**	**Gallons**	**Day**	**Gallons**
1	115,350	1	77,552	1	116,654
2	77,552	2	116,654	2	115,350
3	116,654	3	115,350	3	77,552
4	115,350	4	77,552	4	116,654
5	77,552	5	116,654	5	115,350
6	116,654	6	115,350	6	77,552
7	115,350	7	77,552	7	116,654
Total	**734,462**	**Total**	**696,664**	**Total**	**735,766**
	x 14.7 weeks		x 14.7 weeks		x 14.7 weeks
	10,796,591		**10,240,960**		**10,815,760**

31,853,311
Total Gallons Sprayed

Environmental Agronomics

Schedule

Effluent Spray Events

Actual Flow

North Field	**Middle Field**	**South Field**
4.99 Acres	3.37 Acres	5.21 acres
x 0.51 AI/Day	x 0.51 AI/Day	x 0.51 AI/Day
2.5449 AI	1.7187 AI	2.6571 AI
x 27.154 G/AI	x 27.154 G/AI	x 27.154 G/AI
69,104 G/Field	**46,670** G/Field	**72,151** G/Field

Spraying will occur 35.4 weeks per year when 117.3 days of storage is used. Each weekly spray schedule will occur 11.8 weeks per year.

Weeks Occurring	**Weeks Occurring**	**Weeks Occurring**
1, 4, 7, 10, 13, 16, 19, 22, 25, 28, 31, 34	2, 5, 8, 11, 14, 17, 20, 23, 26, 29, 32, 35	3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33,

Day	**Gallons**	**Day**	**Gallons**	**Day**	**Gallons**
1	69,104	1	46,670	1	72,151
2	46,670	2	72,151	2	69,104
3	72,151	3	69,104	3	46,670
4	69,104	4	46,670	4	72,151
5	46,670	5	72,151	5	69,104
6	72,151	6	69,104	6	46,670
7	69,104	7	46,670	7	72,151
Total	**444,954**	**Total**	**422,520**	**Total**	**448,001**
	x 11.8 weeks		x 11.8 weeks		x 11.8 weeks
	5,250,457		**4,985,736**		**5,286,412**

15,522,605
Total Gallons Sprayed

Environmental Agronomics

Occoquan Forest STP

Water Balance

Month (1)	ET (2)	Precip (3)	Net ET (4) (2-3)	Perc (5)	Hyd Load (6) (4+5)
January	1.2	2.30	-1.10	17.28	16.18
February	1.6	2.35	-0.75	17.28	16.53
March	2.1	2.99	-0.89	17.28	16.39
April	3.3	2.88	0.42	17.28	17.70
May	3.8	3.57	0.33	17.28	17.61
June	4.7	3.43	1.27	17.28	18.55
July	5.3	3.42	1.88	17.28	19.16
August	4.6	3.64	0.96	17.28	18.24
September	3.8	3.27	0.53	17.28	17.81
October	3.0	2.83	0.17	17.28	17.45
November	2.2	2.56	-0.36	17.28	16.92
December	1.4	3.01	-1.61	17.28	15.67
Totals	**37.0**	**36.25**	**0.85**	**207.36**	**208.21**

Weather Data The precipitation data is as provided in the Price William County Soil Survey on page 156 as well as from the Virginia Nutrient Management Standards and Criteria on page 61. The evaporation data is from the Water Atlas of the United States which the USDA Soil Conservation Service uses.

Percolation Soil permeability per the Prince William County Soil Survey is 0.6-6.0 inches/hour. Based on field evaluations, the conservative value of 0.6 inches per hour is used. EPA guidelines indicate the use of 4%-10% of allowable infiltration rate for use in design of a system. Therefore:

0.6 inches/hour x 24 hours/day x 30 days/month x 0.04 = 17.28 inches/month

Based on the above information, hydraulic loading is not restrictive.

Prince William County Service Authority
Occoquan Forest STP

Summary
Trace Element Addition

2003

Parameter	Maximum Trace Element #/A	Recoverable Trace Element mg/l	South SF 3 #/A	Site-Life Years	Middle SF 2 #/A	Site-Life Years	North SF 1 #/A	Site-Life Years
Cadmium (Cd)	35	< 0.0005	**0.003**	11,677	**0.003**	11,667	**0.003**	11,667
Copper (Cu)	1,340	0.012	**0.077**	17,403	**0.063**	21,270	**0.071**	18,873
Lead (Pb)	270	<0.004	**<0.026**	10,385	**<0.021**	12,857	**<0.024**	11,250
Nickel (Ni)	375	<0.004	**<0.026**	14,423	**<0.021**	17,857	**<0.024**	15,625
Zinc (Zn)	2,500	0.012	**0.077**	32,468	**0.063**	39,683	**0.071**	35,211

Lifetime (site-life) limits are calculated by dividing the trace element applied **(bold number)** into the maximum allowable pounds per acre of the trace element.

The total recoverable trace element numbers used are found in the attached **Report Form #2** from this 2003 Annual Report.

The lifetime (site-life) will be restricted by Lead. At the these levels of trace element addition, it will take **10,385** years to reach the maximum allowable pounds per acre of lead.

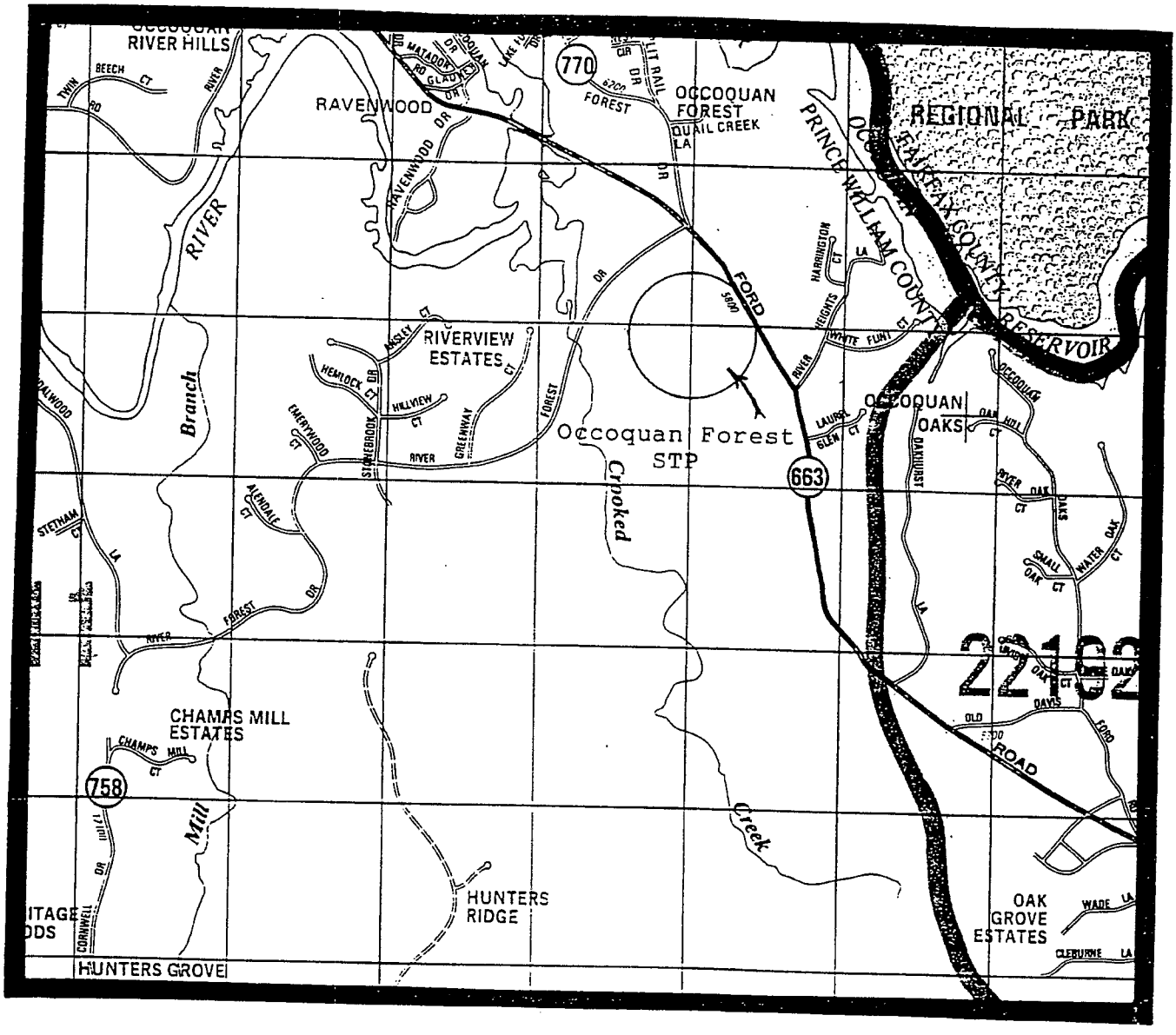
Pounds per acre applied of the trace element is calculated by multiplying the wastewater applied (in million gallons [MG]) times the weight of water (8.34 pounds per gallon) times the mg/l of the recoverable trace element.

ATTACHMENT 6

PART D-1, ITEMS 12, 13, AND 14
SITE CHARACTERIZATION

 Source Data: USGS 400 ft Scale: 1 : 10,400 Detail: 14-0 Datum: WGS84

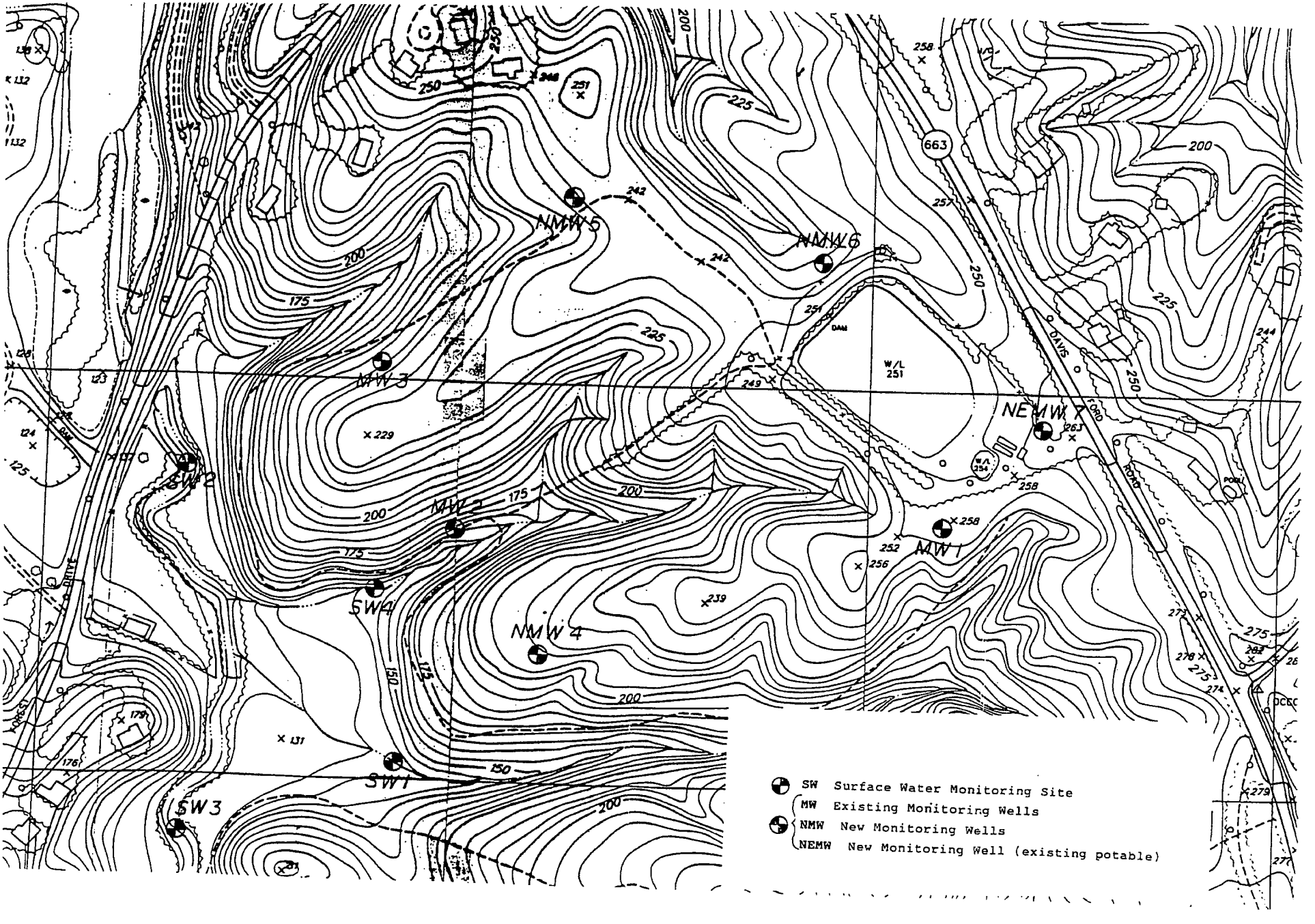
Environmental Agronomics



LOCATION MAP

Prince William County Service Authority
Occoquan Forest STP
Land Treatment System

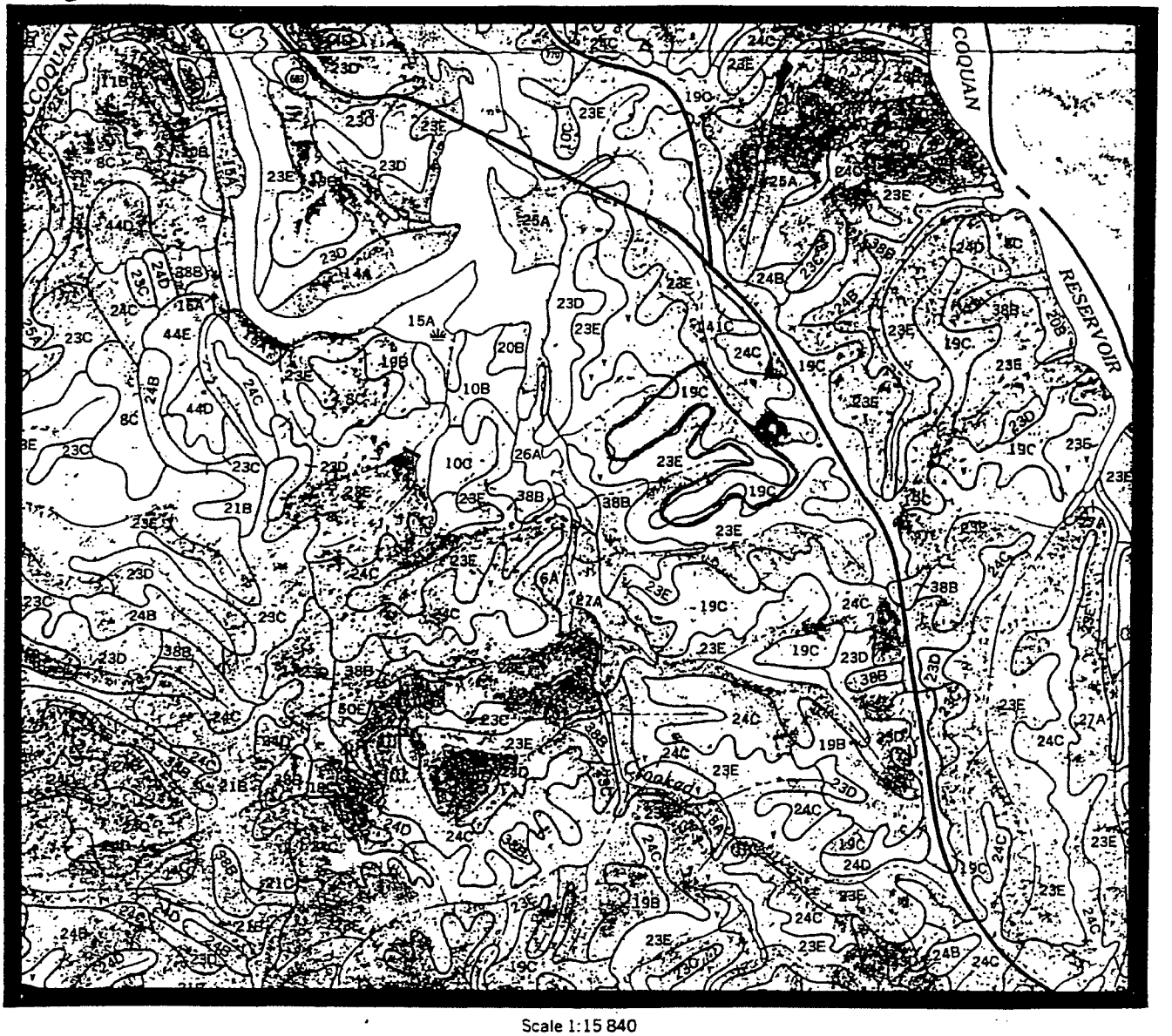
N


NMW5
NMW6
MW3
SW2
MW2
SW4
NMW4
SW1
SW3
NEMW7
MW1
663
DAM
W/L
251
DAVIS
FORD
ROAD
SW Surface Water Monitoring Site
MW Existing Monitoring Wells
NMW New Monitoring Wells
NEMW New Monitoring Well (existing potable)

ATTACHMENT 7

PART D-1, ITEMS 15 AND 16, SOIL SURVEY MAP AND SOIL BORINGS

Environmental Agronomics



Scale 1:15 840

0 Mile

5 000 4 000 3 000 2 000 1 000 0 Feet

SOIL MAP

Prince William County Service Authority
Occoquan Forest STP
Land Treatment System

N

SOIL LEGEND

Publication symbols consist of numbers or a combination of numbers and letters (e.g., 1A, 24C, or 55E. The initial numbers represent the kinds of soil. A capital letter of A, B, C, D, or E, following the first number indicates the class of slope. A final number 3, indicates the unit is severely eroded.

SYMBOL	NAME
1A	Aden silt loam, 0 to 2 percent slopes
2B	Airmont-Weverton complex, 2 to 7 percent slopes
2C	Airmont-Weverton complex, 7 to 15 percent slopes
2D	Airmont-Weverton complex, 15 to 25 percent slopes
2E	Airmont-Weverton complex, 25 to 50 percent slopes
3A	Albano silt loam, 0 to 4 percent slopes
4B	Arcola silt loam, 2 to 7 percent slopes
5C	Arcola-Nestoria complex, 7 to 15 percent slopes
5D	Arcola-Nestoria complex, 15 to 25 percent slopes
6A	Baile loam, 0 to 4 percent slopes
7A	Bermudian silt loam, 0 to 2 percent slopes
8C	Braddock loam, 7 to 15 percent slopes
9B	Brentsville sandy loam, 2 to 7 percent slopes
9C	Brentsville sandy loam, 7 to 15 percent slopes
10B	Buckhall loam, 2 to 7 percent slopes
10C	Buckhall loam, 7 to 15 percent slopes
11B	Calverton silt loam, 0 to 7 percent slopes
12D	Catlett gravelly silt loam, 15 to 25 percent slopes
13B	Catlett-Sycoline complex, 2 to 7 percent slopes
13C	Catlett-Sycoline complex, 7 to 15 percent slopes
14A	Codorus loam, 0 to 2 percent slopes
15A	Comus loam, 0 to 2 percent slopes
16A	Delanco fine sandy loam, 0 to 4 percent slopes
17A	Dulles silt loam, 0 to 4 percent slopes
18C	Dumfries sandy loam, 7 to 15 percent slopes
18D	Dumfries sandy loam, 15 to 25 percent slopes
18E	Dumfries sandy loam, 25 to 50 percent slopes
19B	Elioak loam, 2 to 7 percent slopes
19C	Elioak loam, 7 to 15 percent slopes
20B	Elsinboro sandy loam, 2 to 7 percent slopes
21B	Fairfax loam, 2 to 7 percent slopes
21C	Fairfax loam, 7 to 15 percent slopes
22A	Featherstone silt loam, 0 to 1 percent slopes
23C	Gaila sandy loam, 7 to 15 percent slopes
23D	Gaila sandy loam, 15 to 25 percent slopes
23E	Gaila sandy loam, 25 to 50 percent slopes
24B	Glenelg-Buckhall complex, 2 to 7 percent slopes
24C	Glenelg-Buckhall complex, 7 to 15 percent slopes
24D	Glenelg-Buckhall complex, 15 to 25 percent slopes
25A	Glenville loam, 0 to 4 percent slopes
26A	Hatboro silt loam, 0 to 2 percent slopes
27A	Hatboro-Codorus complex, 0 to 2 percent slopes
28B	Haymarket silt loam, 2 to 7 percent slopes
28C	Haymarket silt loam, 7 to 15 percent slopes
29B	Hoadly loam, 2 to 7 percent slopes

SYMBOL	NAME
30B	Jackland silt loam, 2 to 7 percent slopes
31B	Jackland-Haymarket complex, 2 to 7 percent slopes
31C	Jackland-Haymarket complex, 7 to 15 percent slopes
32A	Kelly silt loam, 0 to 2 percent slopes
33B	Legore-Oakhill complex, 2 to 7 percent slopes
33C	Legore-Oakhill complex, 7 to 15 percent slopes
33D	Legore-Oakhill complex, 15 to 25 percent slopes
34B	Lunt loam, 2 to 7 percent slopes
34C	Lunt loam, 7 to 15 percent slopes
34D	Lunt loam, 15 to 25 percent slopes
35B	Manassas silt loam, 2 to 7 percent slopes
36D	Marr very fine sandy loam, 7 to 25 percent slopes
36E	Marr very fine sandy loam, 25 to 50 percent slopes
37A	Marumsco loam, 0 to 4 percent slopes
38B	Meadowville loam, 0 to 5 percent slopes
39B3	Minnieville clay loam, 2 to 7 percent slopes, severely eroded
39C3	Minnieville clay loam, 7 to 15 percent slopes, severely eroded
40B	Montalto silty clay loam, 2 to 7 percent slopes
40C	Montalto silty clay loam, 7 to 15 percent slopes
41B	Neabsco loam, 0 to 7 percent slopes
41C	Neabsco loam, 7 to 15 percent slopes
42B	Neabsco-Quantico complex, 2 to 7 percent slopes
43D	Nestoria gravelly silt loam, 7 to 25 percent slopes
43E	Nestoria gravelly silt loam, 25 to 50 percent slopes
44D	Occoquan sandy loam, 7 to 25 percent slopes
44E	Occoquan sandy loam, 25 to 50 percent slopes
45C	Oranda loam, 7 to 15 percent slopes
46B	Panorama silt loam, 2 to 7 percent slopes
46C	Panorama silt loam, 7 to 15 percent slopes
47B	Quantico sandy loam, 2 to 7 percent slopes
47C	Quantico sandy loam, 7 to 15 percent slopes
47D	Quantico sandy loam, 15 to 25 percent slopes
48A	Reeville silt loam, 0 to 4 percent slopes
49A	Rowland silt loam, 0 to 2 percent slopes
50D	Spriggs silt loam, 15 to 25 percent slopes
50E	Spriggs silt loam, 25 to 50 percent slopes
51D	Stumptown very flaggy loam, 7 to 25 percent slopes
51E	Stumptown very flaggy loam, 25 to 50 percent slopes
52B	Sudley-Oatlands complex, 2 to 7 percent slopes
52C	Sudley-Oatlands complex, 7 to 15 percent slopes
53B	Sycoline-Kelly complex, 2 to 7 percent slopes
53C	Sycoline-Kelly complex, 7 to 15 percent slopes
54B	Urban land-Udorthents complex, 0 to 7 percent slopes
55D	Watt channery silt loam, 15 to 25 percent slopes
55E	Watt channery silt loam, 25 to 50 percent slopes
56A	Waxpool silt loam, 0 to 2 percent slopes

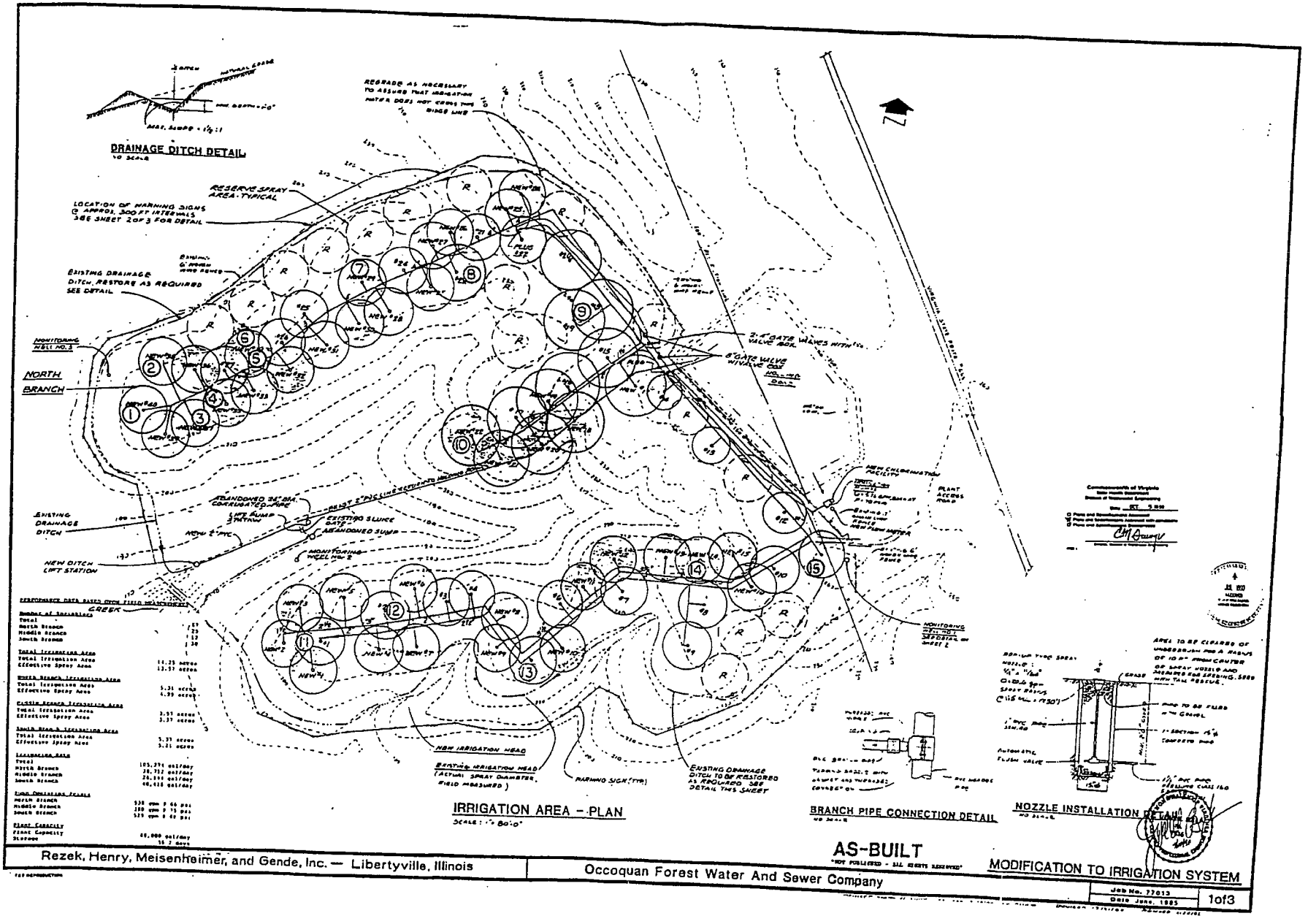
Environmental Agronomics

SOIL BORING INFORMATION SHEET

SITE: Occoquan Forest STP

		Depth to		Permeability			Texture		
Boring	**Soil Type**	**Bedrock (inches)**	**High H_2O Table (inches)**	**Depth (inches)**	**Surface (inches/hr)**	**Sub-Surface (inches/hr)**	**Depth (inches)**	**Surface**	**Sub-Surface**
1, 2, 4, 5, 7, 8, 9, 12, 14, 15	Elioak	>60	>72	0 - 5 5 - 41 41 - 72	0.6 - 2.0	 0.6 - 2.0 0.6 - 2.0	0 - 5	loam	silty clay loam, clay loam, silty clay silt loam, loam, gravelly fine sandy loam
3, 11	Gaila	>60	>72	0 - 7 7 - 15 15 – 43 43 - 72	2.0 - 6.0	 0.6 - 2.0 2.0 - 6.0 2.0 - 6.0	0 - 7 7 – 15 15 - 43 43 - 72	sandy loam	sandy clay loam, loam, sandy loam sandy loam, loam loamy sand, sandy loam, loam
6, 10, 13	Glenelg	>60	>72	0 - 5 5 - 20 20 - 65	0.6 - 2.0	 0.6 2.0 0.6 - 2.0	0 - 5 5 - 20 20 - 65	loam	channery silt loam, silty clay loam, loam loam, sandy loam, channery loam

On site borings verified all three soil types in the spray fields. The predominant soil was Elioak with some Galia and Glenelg occurring on an infrequent basis along the border areas of the spray fields.


DRAINAGE DITCH DETAIL
NO SCALE
REGRADE AS NECESSARY TO ASSURE THAT IRRIGATION WATER DOES NOT CROSS TYPE BINGE LINE
RESERVE SPRAY AREA - TYPICAL
LOCATION OF WARNING SIGNS (@ APPROX. 300 FT INTERVALS SEE SHEET 2 OF 3 FOR DETAIL
EXISTING DRAINAGE DITCH, RESTORE AS REQUIRED SEE DETAIL
MONITORING WELL NO. 3
NORTH BRANCH
EXISTING DRAINAGE DITCH
NEW DITCH LIFT STATION
ABANDONED 36" DIA CORRUGATED PIPE
EXISTING SLUICE GATE
ABANDONED SUMP
MONITORING WELL NO. 2
CREEK
NEW IRRIGATION HEAD
EXISTING IRRIGATION HEAD (ACTUAL SPRAY DIAMETER, FIELD MEASURED)
WARNING SIGN (TYP.)
EXISTING DRAINAGE DITCH TO BE RESTORED AS REQUIRED SEE DETAIL THIS SHEET
8" GATE VALVE W/VALVE BOX
NEW CHLORINATION FACILITY
PLANT ACCESS ROAD
MONITORING WELL NO. 1
IRRIGATION AREA - PLAN
SCALE: 1" = 80'-0"
BRANCH PIPE CONNECTION DETAIL
NOZZLE INSTALLATION DETAIL
AS-BUILT
MODIFICATION TO IRRIGATION SYSTEM
Rezek, Henry, Meisenheimer, and Gende, Inc. — Libertyville, Illinois
Occoquan Forest Water And Sewer Company
Job No. 77613
Date June, 1985
1of3

Environmental Agronomics

Occoquan Forest STP

Soils

Water Holding Capacity

Soil Type	Horizon Depth	Available Capacity	Average Capacity	Inches Water
Elioak	0 – 5	0.12 – 0.24	0.18	0.90
	5 – 41	0.08 – 0.12	0.10	3.60
	41 – 72	0.08 – 0.10	0.09	2.79
				7.29
Galia	0 – 7	0.10 – 0.12	0.11	0.77
	7 – 15	0.10 – 0.18	0.14	1.22
	15 – 43	0.10 – 0.16	0.13	3.64
	43 – 72	0.08 – 0.14	0.11	3.19
				8.72
Glenelg	0 – 5	0.14 – 0.24	0.19	0.95
	5 – 20	0.10 – 0.20	0.15	2.25
	20 – 65	0.10 – 0.19	0.14	6.30
				9.50

The most restrictive soil zone has the capacity to handle **0.282** Acre Inches (AI) per Day of design/permitted flow capacity.

ATTACHMENT 8

PART D-1, ITEM 17, SOIL ANALYSIS

VPA MONITORING REPORT - Occoquan Forest WWTP
VPA Permit No. VPA0007

FORM 3 - Page 1 of 2

Soil Monitoring
LOCATION; South SF - 1 Application Sites

Parameter (1)	Available Phosphorus	Cation Exchange Capacity (CEC)	Exchangeable Calcium	Exchangeable Magnesium	Exchangeable Potassium	Exchangeable Sodium	Exchangeable Sulfur	NH_3-N	Organic Nitrogen
Limit	NL	NL	NL	NL	NL	NL	NL	NL	NL
Unit	ppm	meq/100 g	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Frequency	1/Year	1/Year	1/Year	1/Year	1/Year	1/Year	1/Year	1/Year	1/Year
Sample Type	Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite
Required Reporting	1/Year	1/Year	1/Year	1/Year	1/Year	1/Year	1/Year	1/Year	1/Year
October, 2010	33	7.1	1,015	114	114	75	5	3.8	1,130
October, 2011	38	9.7	1,608	129	129	63	8	3.5	1,200
October, 2012	26	7.4	1,118	124	140	74	10	6.5	1,270
October, 2013	31	7.0	996	112	149	56	8	2.6	1,209
October, 2014	25	7.0	997	115	139	82	10	1.2	1,209

Parameter (1)	Total Nitrogen	Soil Organic Matter	Base Saturation	Exchangeable Sodium Percentage	Acidity	pH	Hydraulic Conductivity	Boron (3)	Chloride (3)
Limit	NL	NL	NL	NL	NL	NL	NL	NL	NL
Unit	ppm	meq/100 g	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Frequency	1/Year	1/Year	1/Year	1/Year	1/Year	1/Year	1/5 Years	1/3 Years	1/3 Years
Sample Type	Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite
Required Reporting	1/Year	1/Year	1/Year	1/Year	1/Year	1/Year	1/5 Years	1/3 Years	1/3 Years
October, 2010	1,130	2.5	5.9	4.6	0.4	6.6	See Report	0.9	51
October, 2011	1,200	2.9	0.0	2.8	0.0	7.1	N/A	1.0	27
October, 2012	1,280	3.8	1.4	4.3	0.1	6.9	N/A	0.8	24
October, 2013	1,210	4.2	5.9	3.5	0.4	6.6	N/A	0.7	18
October, 2014	1,210	4.1	4.5	5.1	0.3	6.7	N/A	0.8	36

VPA MONITORING REPORT - Occoquan Forest WWTP
VPA Permit No. VPA0007

FORM 3 - Page 2 of 2

Soil Monitoring
LOCATION; South SF - 1 Application Sites

Parameter (1)	Molybdenum (3)	Copper (3)	Cobalt (3)	Iron (3)	Manganese (3)	Nickel (3)	Zinc (3)	Particle Size Analysis or USDA Textural Estimate (2)
Limit	NL	NL	NL	NL	NL	NL	NL	NL
Unit	ppm	ppm	ppm	ppm	ppm	ppm	ppm	Percent
Frequency	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/5 Years
Sample Type	Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite
Required Reporting	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/5 Years
October, 2010	<5	7	10	9,030	351	<5	16	36:44:20 Loam
October, 2011	<5	10	9	10,700	440	5	22	47:34:20 Loam
October, 2012	<5	8	12	9,930	484	5	26	40:44:19 Loam
October, 2013	<5	5	7	6,050	368	<5	13	42:38:20 Loam
October, 2014	<5	10	9	12,100	349	7	29	46:38:16 Loam

(1) Soil samples shall be collected in October and results submitted by January 10th of the following year as outlined in the O & M Manual.
(2) Hydraulic conductivity testing and particle size analysis are to be conducted every five years.
(3) Sampling for micronutrients shall be conducted triennially. All metals are to be reported as total metals.

Legend: NL = No Limit (monitoring requirement only)

VPA MONITORING REPORT - Occoquan Forest WWTP
VPA Permit No. VPA0007

FORM 3 - Page 1 of 2

Soil Monitoring
LOCATION; South SF - 2 Application Sites

Parameter (1)	Available Phosphorus	Cation Exchange Capacity (CEC)	Exchangeable Calcium	Exchangeable Magnesium	Exchangeable Potassium	Exchangeable Sodium	Exchangeable Sulfur	NH_3-N	Organic Nitrogen
Limit	NL	NL	NL	NL	NL	NL	NL	NL	NL
Unit	ppm	meq/100 g	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Frequency	1/Year	1/Year	1/Year	1/Year	1/Year	1/Year	1/Year	1/Year	1/Year
Sample Type	Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite
Required Reporting	1/Year	1/Year	1/Year	1/Year	1/Year	1/Year	1/Year	1/Year	1/Year
October, 2010	39	8.4	1,258	124	100	72	6	4.0	1,450
October, 2011	22	8.2	1,181	135	114	60	7	5.5	1,310
October, 2012	17	6.7	953	111	126	69	12	4.3	1,120
October, 2013	21	6.8	972	113	122	56	6	1.7	1,020
October, 2014	16	6.8	946	114	128	65	12	2.4	1,178

Parameter (1)	Total Nitrogen	Soil Organic Matter	Base Saturation	Exchangeable Sodium Percentage	Acidity	pH	Hydraulic Conductivity	Boron (3)	Chloride (3)
Limit	NL	NL	NL	NL	NL	NL	NL	NL	NL
Unit	ppm	meq/100 g	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Frequency	1/Year	1/Year	1/Year	1/Year	1/Year	1/Year	1/5 Years	1/3 Years	1/3 Years
Sample Type	Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite
Required Reporting	1/Year	1/Year	1/Year	1/Year	1/Year	1/Year	1/5 Years	1/3 Years	1/3 Years
October, 2010	1,450	3.4	5.9	3.7	0.5	6.6	See Report	0.8	50
October, 2011	1,310	3	7.4	3.2	0.6	6.5	N/A	0.6	31
October, 2012	1,120	2.8	5.9	4.5	0.4	6.6	N/A	0.7	25
October, 2013	1,020	3.9	5.9	3.6	0.4	6.6	N/A	0.7	18
October, 2014	1,180	4.4	7.4	4.2	0.5	6.5	N/A	0.6	2.1

VPA MONITORING REPORT - Occoquan Forest WWTP
VPA Permit No. VPA0007

FORM 3 - Page 2 of 2

Soil Monitoring
LOCATION; South SF - 2 Application Sites

Parameter (1)	Molybdenum (3)	Copper (3)	Cobalt (3)	Iron (3)	Manganese (3)	Nickel (3)	Zinc (3)	Particle Size Analysis or USDA Textural Estimate (2)
Limit	NL	NL	NL	NL	NL	NL	NL	NL
Unit	ppm	ppm	ppm	ppm	ppm	ppm	ppm	Percent
Frequency	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/5 Years
Sample Type	Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite
Required Reporting	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/5 Years
October, 2010	<5	6	6	9,770	196	<5	11	34:46:20 Loam
October, 2011	<5	11	7	10,400	191	<5	18	43:34:24 Loam
October, 2012	<5	10	7	11,100	199	<5	19	40:39:21 Loam
October, 2013	<5	7	6	7,080	200	<5	13	40:43:17 Loam
October, 2014	<5	13	7	13,600	201	5	26	44:38:18 Loam

(1) Soil samples shall be collected in October and results submitted by January 10th of the following year as outlined in the O & M Manual.
(2) Hydraulic conductivity testing and particle size analysis are to be conducted every five years.
(3) Sampling for micronutrients shall be conducted triennially. All metals are to be reported as total metals.

Legend: NL = No Limit (monitoring requirement only)

VPA MONITORING REPORT - Occoquan Forest WWTP
VPA Permit No. VPA0007

FORM 3 - Page 1 of 2

Soil Monitoring
LOCATION; South SF - 3 Application Sites

Parameter (1)	Available Phosphorus	Cation Exchange Capacity (CEC)	Exchangeable Calcium	Exchangeable Magnesium	Exchangeable Potassium	Exchangeable Sodium	Exchangeable Sulfur	NH_3-N	Organic Nitrogen
Limit	NL	NL	NL	NL	NL	NL	NL	NL	NL
Unit	ppm	meq/100 g	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Frequency	1/Year	1/Year	1/Year	1/Year	1/Year	1/Year	1/Year	1/Year	1/Year
Sample Type	Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite
Required Reporting	1/Year	1/Year	1/Year	1/Year	1/Year	1/Year	1/Year	1/Year	1/Year
October, 2010	64	9.5	1,495	121	112	72	5	4.0	1,390
October, 2011	35	7.3	1,071	109	112	67	9	2.1	1,150
October, 2012	34	6	864	96	138	88	13	4.7	855
October, 2013	40	6.4	883	100	144	77	13	1.4	839
October, 2014	39	6.6	984	101	130	71	9	2.3	1,088

Parameter (1)	Total Nitrogen	Soil Organic Matter	Base Saturation	Exchangeable Sodium Percentage	Acidity	pH	Hydraulic Conductivity	Boron (3)	Chloride (3)
Limit	NL	NL	NL	NL	NL	NL	NL	NL	NL
Unit	ppm	meq/100 g	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Frequency	1/Year	1/Year	1/Year	1/Year	1/Year	1/Year	1/5 Years	1/3 Years	1/3 Years
Sample Type	Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite
Required Reporting	1/Year	1/Year	1/Year	1/Year	1/Year	1/Year	1/5 Years	1/3 Years	1/3 Years
October, 2010	1,390	3.7	4.5	3.3	0.4	6.7	See Report	0.9	51
October, 2011	1,150	2.9	5.9	4.0	0.4	6.6	N/A	0.7	41
October, 2012	860	2.2	2.9	6.4	0.2	6.8	N/A	1.0	28
October, 2013	840	3.8	7.4	5.2	0.5	6.5	N/A	0.2	22
October, 2014	1,090	4.0	2.9	4.7	0.2	6.8	N/A	0.7	25

VPA MONITORING REPORT - Occoquan Forest WWTP
VPA Permit No. VPA0007

FORM 3 - Page 2 of 2

Soil Monitoring
LOCATION; South SF - 3 Application Sites

Parameter (1)	Molybdenum (3)	Copper (3)	Cobalt (3)	Iron (3)	Manganese (3)	Nickel (3)	Zinc (3)	Particle Size Analysis or USDA Textural Estimate (2)
Limit	NL	NL	NL	NL	NL	NL	NL	NL
Unit	ppm	ppm	ppm	ppm	ppm	ppm	ppm	Percent
Frequency	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/5 Years
Sample Type	Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite
Required Reporting	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/3 Years	1/5 Years
October, 2010	<5	4		7,210	50	<5	16	52:36:12 Sandy Loam
October, 2011	<5	11	8	8,970	307	5	23	38:44:18 Loam
October, 2012	<5	12	8	12,300	281	5	26	41:40:19 Loam
October, 2013	<5	7	7	6,650	209	5	13	42:39:19 Loam
October, 2014	<5	15	10	12,500	289	8	31	44:42:14 Loam

(1) Soil samples shall be collected in October and results submitted by January 10th of the following year as outlined in the O & M Manual.

(2) Hydraulic conductivity testing and particle size analysis are to be conducted every five years.

(3) Sampling for micronutrients shall be conducted triennially. All metals are to be reported as total metals.

Legend: NL = No Limit (monitoring requirement only)

Report Number: 14-287-0655
Account Number: 25273

www.aleastern.com

A&L Eastern Laboratories

7621 Whitepine Road Richmond, Virginia 23237 (804) 743-9401 Fax (804) 271-6448

Send To: ENVIRONMENTAL AGRONOMICS
POB 120
QUANTICO MD 21856

Grower:
PRINCE WILLIAM COUNTY SER\
OCCOQUAN FOREST STP

Submitted By: D L JARRETT
Farm ID:

SOIL ANALYSIS REPORT

Analytical Method(s):
Mehlich 3

Date Received: 10/14/2014 **Date Of Analysis:** 10/15/2014 **Date Of Report:** 10/20/2014

Sample ID / Field ID	Lab Number	Organic Matter			Phosphorus				Potassium		Magnesium		Calcium		Sodium		pH		Acidity	C.E.C
		%	Rate	ENR lbs/A	Mehlich 3 ppm	Mehlich 3 Rate	Reserve ppm	Reserve Rate	K ppm	K Rate	Mg ppm	Mg Rate	Ca ppm	Ca Rate	Na ppm	Na Rate	Soil pH	Buffer Index	H meq/100g	meq/100g
SF-1 N SURFACE	24494	4.1	M	122	25	L MD = 30			139	H MD = 88	115	M MD = 90	997	H MD = 99	82	M	6.7		0.3	7.0
SF-1 N SUBSURF/	24495	2.5	L	92	10	VL MD = 13			121	M MD = 77	107	H MD = 84	687	M MD = 60	92	M	6.2		0.7	5.7
SF-2 MID SURFAC	24496	4.4	M	128	16	L MD = 20			128	H MD = 81	114	M MD = 89	946	M MD = 93	65	M	6.5		0.5	6.8
SF-2 MID SUBSUF	24497	2.5	L	93	14	L MD = 18			124	M MD = 79	97	H MD = 77	534	M MD = 41	62	M	5.7	6.82	1.1	5.2
SF-3 S SURFACE	24498	4.0	M	121	39	M MD = 45			130	H MD = 82	101	M MD = 80	984	H MD = 97	71	M	6.8		0.2	6.6

Sample ID / Field ID	Percent Base Saturation					Nitrate		Sulfur		Zinc		Manganese		Iron		Copper		Boron		Soluble Salts		Chloride		Aluminum
	K %	Mg %	Ca %	Na %	H %	NO_3N ppm	Rate	S ppm	Rate	Zn ppm	Rate	Mn ppm	Rate	Fe ppm	Rate	Cu ppm	Rate	B ppm	Rate	SS ms/cm	Rate	Cl ppm	Rate	Al ppm
SF-1 N SURFACE	5.1	13.7	71.2	5.1	4.5			10	L	2.2	L	85	VH	169	VH	2.1	H	0.8	M	0.11	VL	36		
SF-1 N SUBSURF/	5.4	15.6	60.3	7.0	12.2			22	M	1.6	L	67	VH	81	VH	1.8	H	0.6	M	0.12	VL	35		
SF-2 MID SURFAC	4.8	14.0	69.6	4.2	7.4			12	L	1.7	L	40	H	162	VH	1.7	H	0.6	M	0.1	VL	21		
SF-2 MID SUBSUF	6.1	15.5	51.3	5.2	20.9			29	H	1.1	L	35	H	95	VH	1.4	M	0.4	L	0.1	VL	34		
SF-3 S SURFACE	5.1	12.8	74.5	4.7	2.9			9	VL	1.6	L	72	VH	209	VH	2.1	H	0.7	M	0.09	VL	25		

Values on this report represent the plant available nutrients in the soil. Rating after each value: VL (Very Low), L (Low), M (Medium), H (High), VH (Very High). ENR - Estimated Nitrogen Release. C.E.C. - Cation Exchange Capacity.

Explanation of symbols: % (percent), ppm (parts per million), lbs/A (pounds per acre), ms/cm (milli-mhos per centimeter), meq/100g (milli-equivalent per 100 grams). Conversions: ppm x 2 = lbs/A, Soluble Salts ms/cm x 640 = ppm.

This report applies to sample(s) tested. Samples are retained a maximum of thirty days after testing.

Analysis prepared by: A&L Eastern Laboratories, Inc.

by: Pauric McGroary

Pauric McGroary

Report Number: 14-287-0655
Account Number: 25273

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A&L Eastern Laboratories

7621 Whitepine Road Richmond, Virginia 23237 (804) 743-9401 Fax (804) 271-6448

Send To: ENVIRONMENTAL AGRONOMICS
POB 120
QUANTICO MD 21856

Grower:
PRINCE WILLIAM COUNTY SER\
OCCOQUAN FOREST STP

Submitted By: D L JARRETT
Farm ID:

SOIL ANALYSIS REPORT

Analytical Method(s):
Mehlich 3

Date Received: 10/14/2014 **Date Of Analysis:** 10/15/2014 **Date Of Report:** 10/20/2014

Sample ID / Field ID	Lab Number	Organic Matter			Phosphorus				Potassium		Magnesium		Calcium		Sodium		pH		Acidity	C.E.C
		%	Rate	ENR lbs/A	Mehlich 3 ppm	Mehlich 3 Rate	Reserve ppm	Reserve Rate	K ppm	K Rate	Mg ppm	Mg Rate	Ca ppm	Ca Rate	Na ppm	Na Rate	Soil pH	Buffer Index	H meq/100g	meq/100g
SF-3 S SUBSURF/	24499	2.3	L	90	14	L			140	VH	84	H	506	M	83	H	6.2		0.5	4.5
					MD = 18				MD = 89		MD = 67		MD = 37							

Sample ID / Field ID	Percent Base Saturation					Nitrate		Sulfur		Zinc		Manganese		Iron		Copper		Boron		Soluble Salts		Chloride		Aluminum
	K %	Mg %	Ca %	Na %	H %	NO_3N ppm	NO_3N Rate	S ppm	S Rate	Zn ppm	Zn Rate	Mn ppm	Mn Rate	Fe ppm	Fe Rate	Cu ppm	Cu Rate	B ppm	B Rate	SS ms/cm	SS Rate	Cl ppm	Cl Rate	Al ppm
SF-3 S SUBSURF/	8.0	15.6	56.2	8.0	12.1			12	L	1.1	L	27	H	111	VH	1.5	M	0.5	L	0.08	VL	38		

Values on this report represent the plant available nutrients in the soil. Rating after each value: VL (Very Low), L (Low), M (Medium), H (High), VH (Very High). ENR - Estimated Nitrogen Release. C.E.C. - Cation Exchange Capacity.

Explanation of symbols: % (percent), ppm (parts per million), lbs/A (pounds per acre), ms/cm (milli-mhos per centimeter), meq/100g (milli-equivalent per 100 grams). Conversions: ppm x 2 = lbs/A, Soluble Salts ms/cm x 640 = ppm.

This report applies to sample(s) tested. Samples are retained a maximum of thirty days after testing.

Analysis prepared by: A&L Eastern Laboratories, Inc.

by: Pauric McGroary

Pauric McGroary

Report Number
14-287-0655 **Page:** 1 of 12

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Project : PRINCE WILLIAM COUNTY SERVICE AUTHORITY
OCCOQUAN FOREST STP

Submitted By : D L JARRETT
Purchase Order :
Report Date : 10/20/2014
Date Received : 10/14/2014

REPORT OF ANALYSIS

Date Sampled :

Lab Number: 24494
Sample Id : SF-1 N SURFACE

Analysis	Result	Quantitation Limit	Method	Date and Time Test Started	Analyst
Total Kjeldahl Nitrogen , ppm	1210	10.0	SM-4500-NH3C-TKN	10/15/2014 08:39	JM
Total Iron , ppm	12100	100	SW 6010C	10/17/2014 14:44	KM
Total Manganese , ppm	349	5	SW 6010C	10/17/2014 14:44	KM
Total Copper , ppm	10	5	SW 6010C	10/17/2014 14:44	KM
Total Zinc , ppm	29	5	SW 6010C	10/17/2014 14:44	KM
Total Nickel , ppm	7	5	SW 6010C	10/17/2014 14:44	KM
Total Molybdenum , ppm	<5	5	SW 6010C	10/17/2014 14:44	KM
Total Cobalt , ppm	9	5	SW 6010C	10/17/2014 14:44	KM
Nitrogen, Ammoniacal , ppm	1.2	0.1	SOIL AMMONIA-N	10/15/2014 09:00	RD

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Report Number
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Submitted By : D L JARRETT
Purchase Order :
Report Date : 10/20/2014
Date Received : 10/14/2014

REPORT OF ANALYSIS

Date Sampled :

Lab Number: 24494
Sample Id : SF-1 N SURFACE

Analysis	Result	Quantitation Limit	Method	Date and Time Test Started	Analyst

Method Reference:
Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1983
Methods of Soil Analysis, Part 1 - Physical and Mineralogical Methods, 2nd Ed. Rev. Soil Science Society of America, Black, C.A et al. 1982, page 40.
Methods of Soil Analysis, Part 3 - Chemical Methods, 2nd Ed. Rev. Soil Science Society of America, Black, C.A et al. 1982, pages 1185-1186.
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Purchase Order :
Report Date : 10/20/2014
Date Received : 10/14/2014

Project : PRINCE WILLIAM COUNTY SERVICE AUTHORITY
OCCOQUAN FOREST STP

REPORT OF ANALYSIS

Date Sampled :

Lab Number: 24495
Sample Id : SF-1 N SUBSURFACE

Analysis	Result	Quantitation Limit	Method	Date and Time Test Started	Analyst
Total Kjeldahl Nitrogen , ppm	530	10.0	SM-4500-NH3C-TKN	10/15/2014 08:39	JM
Total Iron , ppm	17200	100	SW 6010C	10/17/2014 14:44	KM
Total Manganese , ppm	231	5	SW 6010C	10/17/2014 14:44	KM
Total Copper , ppm	11	5	SW 6010C	10/17/2014 14:44	KM
Total Zinc , ppm	30	5	SW 6010C	10/17/2014 14:44	KM
Total Nickel , ppm	6	5	SW 6010C	10/17/2014 14:44	KM
Total Molybdenum , ppm	<5	5	SW 6010C	10/17/2014 14:44	KM
Total Cobalt , ppm	11	5	SW 6010C	10/17/2014 14:44	KM
Nitrogen, Ammoniacal , ppm	1.8	0.1	SOIL AMMONIA-N	10/15/2014 09:00	RD

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Submitted By : D L JARRETT
Purchase Order :
Report Date : 10/20/2014
Date Received : 10/14/2014
Date Sampled :

REPORT OF ANALYSIS

Lab Number: 24495
Sample Id : SF-1 N SUBSURFACE

Analysis	Result	Quantitation Limit	Method	Date and Time Test Started	Analyst

Method Reference:
Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1983
Methods of Soil Analysis, Part 1 - Physical and Mineralogical Methods, 2nd Ed. Rev. Soil Science Society of America, Black, C.A et al. 1982, page 40
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Project : PRINCE WILLIAM COUNTY SERVICE AUTHORITY
OCCOQUAN FOREST STP

REPORT OF ANALYSIS

Date Sampled :

Lab Number: 24496
Sample Id : SF-2 MID SURFACE

Analysis	Result	Quantitation Limit	Method	Date and Time Test Started	Analyst
Total Kjeldahl Nitrogen , ppm	1180	10.0	SM-4500-NH3C-TKN	10/15/2014 08:39	JM
Total Iron , ppm	13600	100	SW 6010C	10/17/2014 14:44	KM
Total Manganese , ppm	201	5	SW 6010C	10/17/2014 14:44	KM
Total Copper , ppm	13	5	SW 6010C	10/17/2014 14:44	KM
Total Zinc , ppm	26	5	SW 6010C	10/17/2014 14:44	KM
Total Nickel , ppm	5	5	SW 6010C	10/17/2014 14:44	KM
Total Molybdenum , ppm	<5	5	SW 6010C	10/17/2014 14:44	KM
Total Cobalt , ppm	7	5	SW 6010C	10/17/2014 14:44	KM
Nitrogen, Ammoniacal , ppm	2.4	0.1	SOIL AMMONIA-N	10/15/2014 09:00	RD

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Submitted By : D L JARRETT
Purchase Order :
Report Date : 10/20/2014
Date Received : 10/14/2014

REPORT OF ANALYSIS

Date Sampled :

Lab Number: 24496
Sample Id : SF-2 MID SURFACE

Analysis	Result	Quantitation Limit	Method	Date and Time Test Started	Analyst

Method Reference:
Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1983
Methods of Soil Analysis, Part 1 - Physical and Mineralogical Methods, 2nd Ed. Rev. Soil Science Society of America, Black, C.A et al. 1982, page 40
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Report Date : 10/20/2014
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Project : PRINCE WILLIAM COUNTY SERVICE AUTHORITY
OCCOQUAN FOREST STP

REPORT OF ANALYSIS

Date Sampled :

Lab Number: 24497
Sample Id : SF-2 MID SUBSURFACE

Analysis	Result	Quantitation Limit	Method	Date and Time Test Started	Analyst
Total Kjeldahl Nitrogen , ppm	470	10.0	SM-4500-NH3C-TKN	10/15/2014 08:39	JM
Total Iron , ppm	17500	100	SW 6010C	10/17/2014 14:44	KM
Total Manganese , ppm	171	5	SW 6010C	10/17/2014 14:44	KM
Total Copper , ppm	13	5	SW 6010C	10/17/2014 14:44	KM
Total Zinc , ppm	24	5	SW 6010C	10/17/2014 14:44	KM
Total Nickel , ppm	5	5	SW 6010C	10/17/2014 14:44	KM
Total Molybdenum , ppm	<5	5	SW 6010C	10/17/2014 14:44	KM
Total Cobalt , ppm	12	5	SW 6010C	10/17/2014 14:44	KM
Nitrogen, Ammoniacal , ppm	1.9	0.1	SOIL AMMONIA-N	10/15/2014 09:00	RD

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14-287-0655 **Page:** 8 of 12

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Project : PRINCE WILLIAM COUNTY SERVICE AUTHORITY
OCCOQUAN FOREST STP

REPORT OF ANALYSIS

Date Sampled :

Lab Number: 24497
Sample Id : SF-2 MID SUBSURFACE

Analysis	Result	Quantitation Limit	Method	Date and Time Test Started	Analyst

Method Reference:
Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1983
Methods of Soil Analysis, Part 1 - Physical and Mineralogical Methods, 2nd Ed. Rev. Soil Science Society of America, Black, C.A et al. 1982, page 40
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Project : PRINCE WILLIAM COUNTY SERVICE AUTHORITY
OCCOQUAN FOREST STP

Submitted By : D L JARRETT
Purchase Order :
Report Date : 10/20/2014
Date Received : 10/14/2014

REPORT OF ANALYSIS

Date Sampled :

Lab Number: 24498
Sample Id : SF-3 S SURFACE

Analysis	Result	Quantitation Limit	Method	Date and Time Test Started	Analyst
Total Kjeldahl Nitrogen , ppm	1090	10.0	SM-4500-NH3C-TKN	10/15/2014 08:39	JM
Total Iron , ppm	12500	100	SW 6010C	10/17/2014 14:44	KM
Total Manganese , ppm	289	5	SW 6010C	10/17/2014 14:44	KM
Total Copper , ppm	15	5	SW 6010C	10/17/2014 14:44	KM
Total Zinc , ppm	31	5	SW 6010C	10/17/2014 14:44	KM
Total Nickel , ppm	8	5	SW 6010C	10/17/2014 14:44	KM
Total Molybdenum , ppm	<5	5	SW 6010C	10/17/2014 14:44	KM
Total Cobalt , ppm	10	5	SW 6010C	10/17/2014 14:44	KM
Nitrogen, Ammoniacal , ppm	2.3	0.1	SOIL AMMONIA-N	10/15/2014 09:00	RD

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Report Number
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Submitted By : D L JARRETT
Purchase Order :
Report Date : 10/20/2014
Date Received : 10/14/2014

Project : PRINCE WILLIAM COUNTY SERVICE AUTHORITY
OCCOQUAN FOREST STP

REPORT OF ANALYSIS

Date Sampled :

Lab Number: 24498
Sample Id : SF-3 S SURFACE

Analysis	Result	Quantitation Limit	Method	Date and Time Test Started	Analyst

Method Reference:
Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1983
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Comments:

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Report Number
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QUANTICO , MD 21856

Project : PRINCE WILLIAM COUNTY SERVICE AUTHORITY
OCCOQUAN FOREST STP

Submitted By : D L JARRETT
Purchase Order :
Report Date : 10/20/2014
Date Received : 10/14/2014
Date Sampled :

REPORT OF ANALYSIS

Lab Number: 24499
Sample Id : SF-3 S SUBSURFACE

Analysis	Result	Quantitation Limit	Method	Date and Time Test Started	Analyst
Total Kjeldahl Nitrogen , ppm	410	10.0	SM-4500-NH3C-TKN	10/15/2014 08:39	JM
Total Iron , ppm	15000	100	SW 6010C	10/17/2014 14:44	KM
Total Manganese , ppm	171	5	SW 6010C	10/17/2014 14:44	KM
Total Copper , ppm	15	5	SW 6010C	10/17/2014 14:44	KM
Total Zinc , ppm	30	5	SW 6010C	10/17/2014 14:44	KM
Total Nickel , ppm	6	5	SW 6010C	10/17/2014 14:44	KM
Total Molybdenum , ppm	<5	5	SW 6010C	10/17/2014 14:44	KM
Total Cobalt , ppm	10	5	SW 6010C	10/17/2014 14:44	KM
Nitrogen, Ammoniacal , ppm	2.2	0.1	SOIL AMMONIA-N	10/15/2014 09:00	RD

Pauric McGroary

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Project : PRINCE WILLIAM COUNTY SERVICE AUTHORITY
OCCOQUAN FOREST STP

Submitted By : D L JARRETT
Purchase Order :
Report Date : 10/20/2014
Date Received : 10/14/2014

REPORT OF ANALYSIS

Date Sampled :

Lab Number: 24499
Sample Id : SF-3 S SUBSURFACE

Analysis	Result	Quantitation Limit	Method	Date and Time Test Started	Analyst

Method Reference:
Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1983
Methods of Soil Analysis, Part 1 - Physical and Mineralogical Methods, 2nd Ed. Rev. Soil Science Society of America, Black, C.A et al. 1982, page 40
Methods of Soil Analysis, Part 3 - Chemical Methods, 2nd Ed. Rev. Soil Science Society of America, Black, C.A et al. 1982, pages 1185-1186.
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Comments:

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TEXTURE ANALYSIS

Client : ENVIRONMENTAL AGRONOMICS POB 120 QUANTICO, MD 21856	Grower : PRINCE WILLIAM COUNTY SERVICE AUTHORIT OCCOQUAN FOREST STP Farm:	Report No : 14-287-0655 Cust No : 25273 Date Printed : 10/20/2014 Page : 1 of 1 Submitted By : D L JARRETT Date Received : 10/14/2014

Lab No	Field ID	Sample Identification	Percent Sand	Percent Silt	Percent Clay	Textural Classification
24494		SF-1 N SURFACE	46.0	38.0	16.0	Loam
24495		SF-1 N SUBSURFACE	36.0	36.0	28.0	Clay Loam
24496		SF-2 MID SURFACE	44.0	38.0	18.0	Loam
24497		SF-2 MID SUBSURFACE	38.0	32.0	30.0	Clay Loam
24498		SF-3 S SURFACE	44.0	42.0	14.0	Loam
24499		SF-3 S SUBSURFACE	40.0	32.0	28.0	Clay Loam

Analysis prepared by: A&L Eastern Laboratories, Inc.

ATTACHMENT 9

PART D-1, ITEMS 18 AND 19
CROP AND SITE MANAGEMENT

Environmental Agronomics

Occoquan Forest STP

Agronomic Practices

This Land Treatment System was developed over twenty (20) years age for the utilization of municipal wastewater in a forest ecosystem. The site was developed on very deep and deep well drained and somewhat excessively drained soils that have a clayey or loamy subsoil. The system is on medium-wide to narrow ridge tops with an erosion control structure built on the side slopes to prevent any runoff of the sprayed wastewater. A reverse bench structure or drainage ditch surrounding the spray fields protects the entire site. This forest system contains primarily mixed hardwood species with a large percentage of the area containing understory, which breaks the impact of the sprayed wastewater reducing the potential for runoff or erosion. The wastewater is being used in this system for irrigating the hardwood species as well as supplying nutrients (N-P-K) to increase their production. The current production of wastewater is providing approximately 50% of the required nutrients for maximum tree production. At this time, it is unlikely that any additional nutrients will be added to this spray site. The tree species will be cruised by a forester in the future for select harvesting the mature trees.